TV & VIDEO * AUDIO * COMPUTERS * AUTO ELECTRONICS!

WIN ONE OF 15 HP MULTIMETERS!

NDD

Electronics

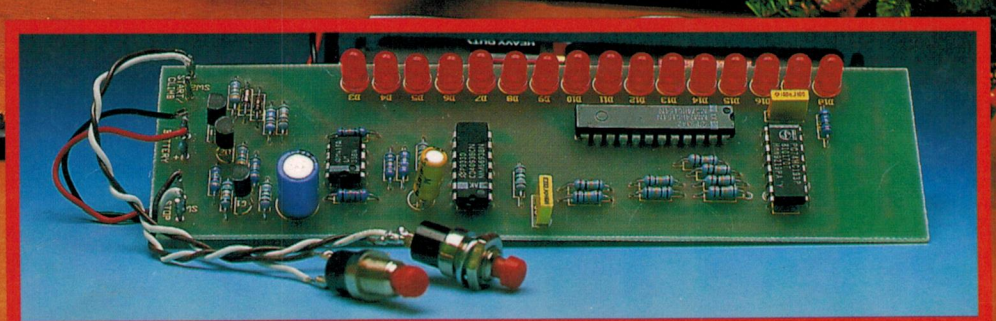
AUSTRALIA WITH ETI

DECEMBER 1994 $4.95*
NZ $6.95 incl GST

PREVIEW OF THE NEW PHILIPS INTERACTIVE/VIDEO CD PLAYER

BUILD OUR NEW 'SHOESTRING' STEREO AMP

SPECIAL FEATURE ON DATA MODEMS



NEW 'DISCOVERY' PROJECTS FROM DICK SMITH ELECTRONICS

AUSTRALIAN PUBLICATION

9 312966 123633 12

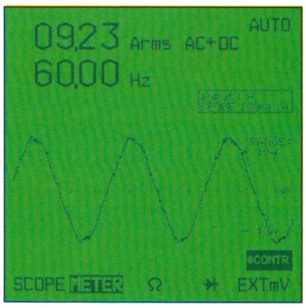
Print Post Approved PP255003/01056

Introducing ScopeMeter® Series II.

If you thought the original ScopeMeter was good, then take a look at these new features!

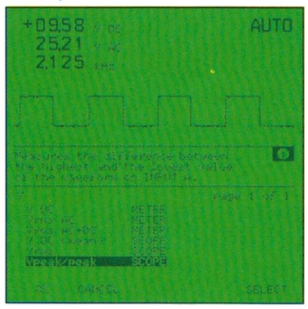
SCOPE METER

A 50 MHz, 2 channel, 25MS/s scope combined with a $3^{2}/_{3}$ digit true rms meter.



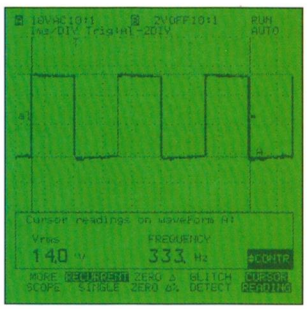
MEASURE MENU

One touch gives you direct access to more than 30 automatic measurement setups.



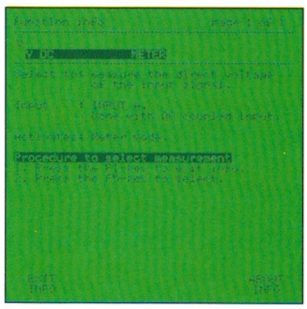
AUTO SET

As you probe from test point to test point, ScopeMeter automatically adjusts the timebase and amplitude for a stable waveform.



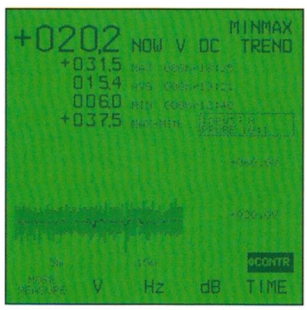
i

No matter what function you're using, on-line information is just a button away.



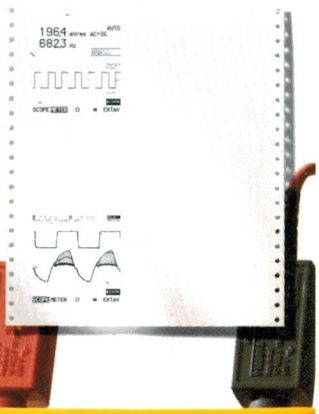
MIN MAX

Simultaneously graph and display Min/Max/Avg measurements over time for monitoring trends and intermittents.



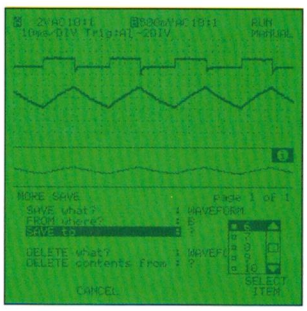
START PRINT

Print directly from ScopeMeter or download to a PC for further analysis.



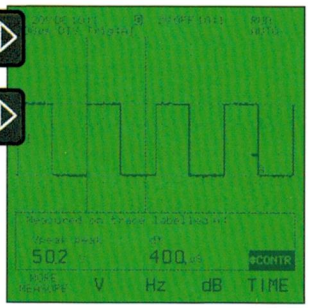
SAVE

Large non-volatile memory stores screen images, setups and waveforms.



LEFT CURSOR **RIGHT CURSOR**

Cursors help you make more than 15 precise waveform measurements.



It works wherever you work.

ScopeMeter Series II is the battery-powered, combination scope and meter designed for easy measurements on-the-go. It automatically configures itself to do what you want. Just push the measure menu button and select one of 30 measurements – automatic readings and waveforms. The continuous Autoset feature instantly adjusts the timebase and amplitude. There's still manual controls, but Series II being so fast and easy, why would you use anything else?

Many users work in wet, dusty and dirty environments. So Series II has a ruggedized and sealed case. And the backlit screen makes for easy readings in bright light and no-light locations.

There are four ScopeMeter Series II models to choose from priced from $1980 ex tax. And that includes probes and accessories.

Discover how the most popular portable combination scope and meter can make your job easier. Call us for details on the ScopeMeter Series II.

Also ask for a copy of our latest Test & Measuring Instrument Shortform.

FLUKE

OBIAT PTY LTD

129 Queen Street, Beaconsfield. P.O.Box 37 Beaconsfield NSW 2014
Tel : (02) 698 4111 Fax : (02) 699 9170

bankcard VISA MasterCard

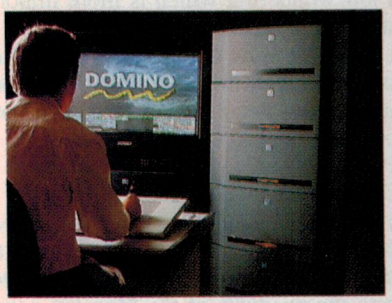
READER INFO NO. 1

Electronics AUSTRALIA WITH ETI

Volume 56, No.12
December 1994

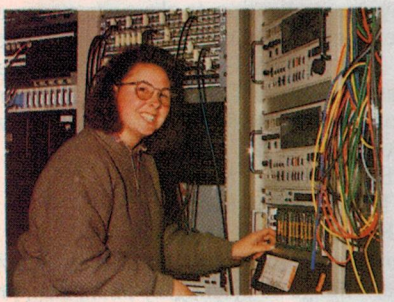
AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Digital image manipulation



Digital editing, production and image manipulation systems have radically changed broadcast television in the last 10 years. Barrie Smith looks at British company Quantel and the way its image editing systems are having the same effect on film production, in his article starting on page 20...

Jobs in radio and TV



The broadcasting industry isn't the easiest to break into, but it can be done if you use the right approach. Bryce Templeton gives some practical advice on how to go about it, in his down-to-earth career advice article starting on page 26.

On the cover

Dick Smith Electronics is justifiably proud of its new Discovery series of construction kits, which are designed to continue the remarkable success of its Funway series, in helping a great many people get a 'hands on' introduction to practical electronics. See our story, starting on page 46...

Video and Audio

6 **WHAT'S NEW IN VIDEO & AUDIO** *Dynaco low cost surround sound decoders*
8 **THE CHALLIS REPORT** *A preview of Philips' new CD-i video CD player...*
20 **QUANTEL ROLLS THE DIGITAL DOMINO** *Impressive image editing systems*

Features

14 **ATM: MOVING VOICE, VIDEO & DATA** *At very high speeds!*
26 **SO YOU WANT A JOB IN RADIO OR TV?** *Practical career advice...*
28 **WHEN I THINK BACK...** *Harry Mauger, recording engineer — 2*
38 **MOFFAT'S MADHOUSE** *Is Telecom's security too lax?*

Projects and Technical

40 **THE SERVICEMAN** *Amazing that this set had ever worked at all!*
44 **CIRCUIT & DESIGN IDEAS** *Telephone ring simulator, temperature controller*
46 **NEW 'DISCOVERY SERIES' KITS FROM DSE** *Learn more by building more*
56 **BUDGET PRICED 'SHOESTRING' STEREO AMP** *Good for 'surround', too!*
68 **INTELLIGENT SOLAR BATTERY CHARGER - 2** *How it works, construction*
72 **POCKET PACKET FOR THE MAC** *Software plus simple hardware adaptor...*
78 **AUTOMOTIVE ELECTRONICS** *The PC revolution in engine analysers*
91 **VINTAGE RADIO** *Building a 70 year old classic Browning-Drake*

Professional Electronics

100 **NEWS HIGHLIGHTS** *Philips reveals 'end to end' digital TV system at IBC*
104 **DIGITAL PULSE GENERATOR USING AN EPLD - 1** *Using Altera's EPM7064*
108 **NEW PRODUCTS** *Surface mount PCB tester, compact handheld GPS receiver*
110 **SOLID STATE UPDATE** *20MHz function generator, isolated motor control IC*
112 **FEATURE: MODEMS & DATA COMMS** *Making modems more meaningful*
117 **FEATURE: MODEMS & DATA COMMS** *The latest products available...*
120 **FEATURE: MODEMS & DATA COMMS** *Askey's Dynalink 1414VQE modem*
122 **FEATURE: MODEMS & DATA COMMS** *Twincom's high speed dual serial card*
124 **SILICON VALLEY NEWSLETTER** *Stanford breakthrough in 3D memory*
126 **COMPUTER NEWS & NEW PRODUCTS** *PCMCIA 12-bit data acquisition card*

Columns and Comments

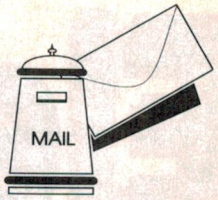
4 **LETTERS TO THE EDITOR** *Howard Kingsley Love, noise cancelling phones*
5 **EDITORIAL VIEWPOINT** *A look into the future of compressed digital video, on CD*
34 **FORUM** *More on the disposal of electronic scrap, and on soldering safety*
81 **SHORTWAVE LISTENING** *Difficulties during wartime listening*
84 **INFORMATION CENTRE** *Lightning, baluns, full names and DMM repairs...*

Departments

24 **BOOK REVIEWS**
96 **MARKETPLACE**
98 **EA HISTORY, CROSSWORD**
130 **DIRECTORY OF SUPPLIERS**
130 **ADVERTISING INDEX**
– **NOTES AND ERRATA**

MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
GRAPHICS/PRODUCTION EDITOR
Milli Godden
TECHNICAL EDITOR
Rob Evans, CET (RMIT)
TECHNICAL CONSULTANT
Peter Phillips, B.Ed., Dip Ed., ECC
CONTRIBUTORS
Louis Challis
Arthur Cushen, MBE
Peter Lankshear
Jim Lawler, MTETIA
Tom Moffat, VK7TM
Neville Williams, FIREE, VK2XV
Nick De Vries, MIAME, AMSAE
DRAFTING
Karen Rowlands
COVER DESIGNER
Clive Davis
PRODUCTION
Ray Eirth
CIRCULATION MANAGER
Michael Prior
PUBLISHER
Michael Hannan
ADVERTISING MANAGER
Selwyn Sayers
Phone (02) 353 0734; fax (02) 353 0613.
ADVERTISING PRODUCTION
Karla Dixon, phone (02) 353 0713
SECRETARY
Anna Maria Zamora
HEAD OFFICE - EDITORIAL
P.O. Box 199, Alexandria 2015.
180 Bourke Road, Alexandria 2015.
Phone: (02) 353 0620. Fax: (02) 353 0613
Reader Services: Phone (02) 353 0620
Subscriptions enquiries: phone (02) 353 9992
Book Shop enquiries: phone (02) 353 9944
INTERSTATE ADVERTISING OFFICES
MELBOURNE: 504 Princes Highway, Noble Park, Vic 3174. Phone (03) 213 3222.
Fax: (03) 701 1534, Pilar Misa.
BRISBANE: 26 Chermside Street, Newstead, Qld 4006. Phone: (07) 854 1119.
Fax: (07) 252 3692, Graham Smith.
ADELAIDE: 98 Jervois Street, Torrensville, SA 5031. Phone: (08) 352 8666,
Fax: (08) 352 6033, Kerryn Delaney.
PERTH: Allen & Associates, 54 Havelock Street, West Perth, WA 6005. Phone: (09) 321 2998,
Fax (09) 321 2940, Tony Allen.
UNITED KINGDOM: John Fairfax & Sons (Aust), 12 Norwich Street, London, EC4A 1BH.
Phone: (71) 353 9321, Fax: (71) 583 0348
ASIA: Headway Media Services Ltd, Room 2101, Causeway Bay Centre, 15-23 Sugar Street, Hong Kong. Phone: 516 8002,
Fax: (862) 890 4811, Adrian Batten.
ELECTRONICS AUSTRALIA is published by Federal Publishing Company a division of Eastern Suburbs Newspapers Partnership, which is owned by
General Newspapers Pty Ltd.
A.C.N. 000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N. 000 237 598 and
Brehmer Fairfax Pty Ltd.
A.C.N. 008 629 767,
180 Bourke Road, Alexandria, NSW 2015.
Copyright © 1994 by Federal Publishing Company, Sydney. All rights reserved.
No part of this publication may be reproduced in any way without written permission from the Publisher or the Managing Editor.
Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo NSW, 2830, phone (068) 843 444, for Federal Publishing Company.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Road, Alexandria, NSW 2015; Phone: (02) 353 9911.
ISSN 1036-0212
*Recommended and maximum Australian retail price.
The Australian Publication emblem on the front cover of this magazine is there to signify proudly that the editorial content in this publication is largely produced and edited in Australia, and that most of the advertisements herein are the products and services available within Australia.

LETTERS TO THE EDITOR



Howard Kingsley Love

I was so very pleased to read Mr Williams' article, as H.K. Love was my father. For years I have been hoping someone would recognise my father's radio expertise as one of the original pioneers in ham radio.

I have often contemplated writing down things I remember about his life, but my knowledge of the workings of Kingsley Radio were limited, as my father died when I was in my early 20's and coping with a young family.

To read about many of the staff and how the business operated brought back many memories of the 1940's and I am only sorry we lost touch with so many friends and staff, due to the trauma of my father's early death and the sadness and regret we felt when the business was wound up. I would like to send good wishes to Lay Cranch, who was mentioned in the article.

My father's wireless room was always the hub of much activity and there was great excitement when CQ brought in overseas hams on the loudspeaker, keeping the family awake till all hours!

Morse was part of radio in the 20's and my mother was often brought into the wireless room to interpret some distant contact as she had been trained as a telegraphist in England. VK3KU and 3BM were two call signs well known in those days.

When my father died at 52, a great pioneer of radio was lost far too early.

Mrs Kathryn Lechte,
Castlemaine, Vic.

Help wanted

I am writing to your magazine in the hope that one of your readers may know where I can obtain a copy of the CCD Camera Cookbook by Berry, Munger + Kanto, and also a company who sells CCD's in unit quantities.

While I am writing I feel it necessary to point out a classic gaffe by Peter Lankshear in his July column where he not only credits Marconi with inventing radio but reproduces several circuits that are in Tesla's Colorado Springs notebook and accredits those to Marconi, while I myself think that Marconi is to radio what John Logie Baird is to television. I don't think anyone would ignore Joseph Swan when writing about the invention of the light bulb, so why do we insist on ignoring Tesla's contribution to radio? In fact, the last time that this magazine mentioned the two together was in J.L. Elkhorne's series of articles of 1983 and I am left wondering which is more important, myth or truth...

I don't see how it's possible that radio could have been invented after the Radio Control Boat which is where it is if you accept Marconi as the inventor of radio.

Paul Kosonen,
Dianella, WA.

Comment: You seem to have misinterpreted Peter Lankshear's text, Paul. The references in the July column are to the products of the Marconi company, not the personal chievements of Guglielmo Marconi the inventor.

Serviceman slip-up

A small point regarding the Serviceman article, in September. Many young up and coming techs possibly read this article for an inside view of the practical side of the trade. So why don't you pay more attention to the correctness of the article. In short, the JVC power supply fault. If R903 was open circuit as stated, for the conclusive fault, there would be no B+ at any time! Should have been R905 (27k).

Bob Jakins,
Technical Applications,
Kenmore, Qld.

Comment: Sorry for the slip, Bob. We check things as thoroughly as we can, but the occasional typo slips through.

Noise cancelling

I was recently at the local Dick Smith Electronics store and was very impressed with their latest noise cancelling headphone device. I put the headphones on and could still hear all the road noises, rumblings and talking. Then I turned the unit on and a few seconds later, everything went quiet except for the talking. Wouldn't the world be a much quieter place if this impressive technology was used more in the domestic market.

Could you please explain how this concept works?

Chris Bebb,
North Ryde, NSW.

Comment: Louis Challis covered this

technology rather well in his review of the ANVT noise cancelling phones, Chris. It was publshed in the June 1994 issue.

Antenna Tech's Association

I wish to introduce the Antenna Technicans Association (Inc. in Victoria).

Our Association was formed in 1985, and incorporated in 1986, with five principal objectives:

1. To create public awareness of a quality television picture;
2. To keep members abreast of technical change.
3. To 'raise the standards' of workmanship within the industry;
4. To represent member's concerns to local authorites, state and federal governments.
5. To cooperate with manufacturers, importers and wholesalers, and similar organisations, in those matters relevant to our industry.

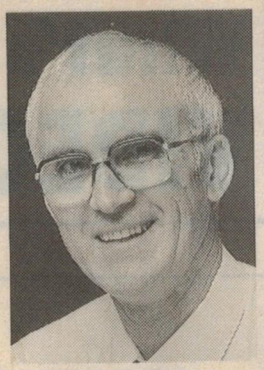
To meet these objectives, we have embarked on various courses of action. Most importantly, we have imposed certain conditions on members to which they must agreed to be legally bound before full membership can be conferred. Additionally, we set minimum standards regarding qualification, test equipment, and legal status. Our membership base includes wholesaler/manufacturers, and individual installer companies as well as the Moorabbin College of TAFE. All installer class members must be qualified in terms of our own TAFE courses (or equivalent, as determined by the Executive Committee). The ATA also runs a course on Satellite System Installation, coordinated by the Moorabbin College of TAFE. Meetings, usually featuring guest speakers, are held monthly, and industry news and information are swapped amongst members. Machinery matters are handled by an executive Committee of seven elected individuals, while the Association retains a paid minutes secretary.

The Association exists to raise the profile of the industry through the pursuit of its pbjectives mentioned above. It welcomes any input from persons/organisations which can assist in its task.

Grant Morrissey, VP,
Antenna Technicians Association,
PO Box 160,
Mitcham, VIC 3121.

Letters published in this column express the opinions of the correspondents concerned, and do not necessarily reflect the opinions or policies of the staff or publisher of Electronics Australia. We reserve the right to edit letters which are very long or potentially defamatory.

EDITORIAL VIEWPOINT



A look into the future of compressed digital video, on CD...

We have some really interesting reading for you this month. For a start, Louis Challis had the opportunity to try out and test an advance sample of one of the new Philips CD-i players, due to be released here around March next year. These are the CD players which play compressed Digital Video as well as Photo CD discs, you may recall, and as a result they provide an excellent preview of the burgeoning digital revolution in video, imaging and cable/satellite TV.

Philips very kindly provided samples of a broad range of software with the CD-i player, including both 'interactive' discs as well as the 'linear' variety (i.e., movies). This allowed Louis (and myself, after he'd finished!) to get a very good idea of not only the potential of CD-i for delivering interactive education and training software, but also the kind of picture and sound quality we can expect from it when delivering linear entertainment software. And frankly, we were very impressed — especially by the samples of software made very recently.

I'm sure you'll find Louis' report particularly interesting, then. By the way, his tests showed that the CDI 210 is also an extremely good performer as a 'straight' audio CD player, as well...

Another article that makes very informative and timely reading is Robert Owen's update on ATM technology. No, not automatic teller machines, but *asynchronous transfer mode* — the high speed data communications technology that's being developed as a key component for the 'data superhighway' we keep on hearing so much about. It's ATM that will soon make it possible for us to send and receive video, hifi audio, pictures and other high bandwidth data, just as easily as we now send and receive phone calls and faxes. So it's a technology that we all need to know more about.

In this issue we also announce the release by Dick Smith Electronics of its new 'Discovery Series' of electronics project kits, designed to continue the tradition begun by DSE's very popular Funway Series. The Funway projects have helped large numbers of young (and not so young) people get their first good 'feel' for electronics, and the new Discovery Series looks set to build upon this admirable record. We're presenting the first of the projects in this issue, and later projects will follow in the coming months.

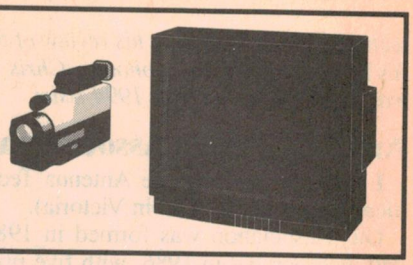
I suspect one of our own projects is likely to attract a lot of interest this month, too. Rob Evans has designed a really great little economy stereo amplifier that we've dubbed the Shoestring Amp, because it delivers so much performance for so little outlay. It's easy to build, delivers 15W per channel and would be ideal for adding 'surround sound' to an existing stereo setup, for example...

There's lots more as well, of course. So read it and enjoy!

To close off, on behalf of everyone here on the *EA* team I'd like to extend our warmest good wishes for the coming Christmas and New Year season, to both our readers and advertisers. Hopefully you'll all join with us in wishing a speedy recovery to our former Editor-in-Chief and regular contributor Neville Williams, who is currently recuperating from a very nasty encounter with a life-threatening virus.

Jim Rowe

What's New in VIDEO and AUDIO





New preamp & amp from Audiosound Labs

A new preamp and two matching power amplifiers have been released by Australian audio equipment manufacturer Audiosound Laboratories. The new C-1 Preamp is available with either the LD50 or LD100 Power Amplifiers, both of which are MOSFET designs offering 50W or 100W of output power respectively.

Along with all of the traditional controls and facilities, the C-1 Preamp includes two new innovative filters, one designed to enhance the overall performance with many loudspeaker systems and the other to provide enhanced reproduction from conventional LP vinyl recordings.

As many small speakers roll off at the bass end before the music does, the C-1's 'Filter/Eq' function extends the low bass response naturally and without colouring the sound. For enhanced LP reproduction, the C-1 includes a separate and isolated phono preamp with direct-coupled inputs — together with a high-slope, active rumble filter which operates at a frequency of 40Hz. This is high enough to make it effective in reducing noise and distortion, as well as limiting loudspeaker cone excursions in the non-audible bass region.

As the phono preamp is on a separate PCB from the rest of the preamp circuitry, it can be deleted from the C-1 for customers who are no longer interested in playing LP recordings.

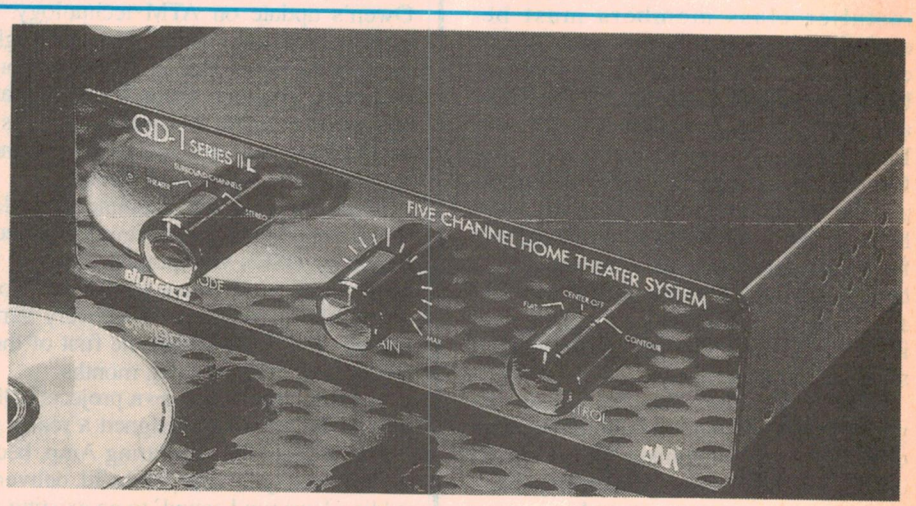
The new LD50 and LD100 power amplifiers are the latest versions of Audiosound's well-respected LD series, which since its introduction 10 years ago has achieved a reputation for ruggedness and reliability.

Further information is available from Audiosound Laboratories, 148 Pitt Road, North Curl Curl 2099; phone (02) 938 2068.

Low cost, clean surround sound

With the current renewed emphasis on domestic surround sound and 'home theatre' installations, many manufacturers have opted for systems based on active surround sound decoding, digital signal processing and delay lines, etc. However this approach is relatively costly, and also open to criticism from purists regarding the inevitable signal degradation resulting from extensive signal processing.

US firm Dynaco has taken the opposite approach, and produced two low cost surround sound decoders based on simple passive circuitry of the type developed back in the early 1970's by audio pioneer David Hafler. Hafler's original QD-1 decoder was very popular and effective, and Dynaco's new QD-1 Series II and QD-2 Passive Matrix Decoders are basically enhanced and updated versions of it.



Like the original QD-1, the new models connect to the left and right speaker outputs of a standard stereo amplifier, and derive 'L-R' ambience information from them by simple passive subtraction. Two additional rear speakers can be fed with this ambience signal, to diffuse the source and give a 'surround' effect.

The new units also derive a 'centre front' signal as well, by passive addition — to create an additional channel and 'fill in' the front of the sound field. They also provide a control to adjust balance between the main front and derived channel levels, and optional switched contour filtering (7kHz rollover) for the rear and centre front channels. The basic model QD-1 sells for only $195, while the enhanced model QD-2 sells for $259 and includes high quality gold plated binding posts for all speaker connections, as well as a gold chrome front panel.

Both units are only available from the sole importer and distributor for Dynaco, VideoCam Accessories of PO Box 2000, Strawberry Hills 2012; phone (02) 698 1470.

New Sony laser disk players

Sony Australia has released two new laser disc players, one ideal for creating a home theatre and the other specifically for Karaoke.

The MDP-850D is designed to be connected to a TV and hi-fi system, or Dolby Pro-Logic receiver, to produce the ultimate in home theatre and home entertainment. As well as laser discs (LD), the player can also play compact discs. This model has PAL/NTSC dual playback so movies from the US, as well as Britain and Australia, can be played. In NTSC mode, the MDP-850D delivers 425 lines of horizontal resolution, which is claimed to provide clarity and 'vibrance' often missing in NTSC software.

The MDP-850D also features C-Quick reverse. This means that you no longer have to get up to change sides of the disc during a movie. Simply press a button on the remote commander, and the other side will commence playing in seconds.

As a CD player, the MDP-850D features Sony's exclusive Hybrid Pulse D/A converter. It also employs a Complementary PLM (pulse length modulation) technique, which is said to provide an extremely high degree of signal resolution.

The MDP-A600K also plays LDs and CDs, but is specially designed for Karaoke sing-a-longs. This NTSC-only model also features Sony's C-Quick Reverse, as well as memory play.

It has Action Playback Start, which means the player will automatically turn on and play the disc when the play button is pressed, even when the player is off.

Both the Sony MDP-850D and the MDP-A600K are available now for $2199 and $1699 respectively, at electronics and department stores.

Portable audio from Panasonic

Panasonic's new RX-E300 CD Radio Cassette Recorder features attractive new low profile styling for desktop use. It has a four preset equaliser (S-XBS, Soft, Clear or Vocal), MASH D-A converter and Super XBS system for high quality sound reproduction.

The four amplifier, four speaker system delivers an output power of 60 watts (PMPO) from the detachable speakers. A wireless remote control unit controls all functions including CD to tape editing.

The RX-E300 also has a helpful new feature known as Easy Auto CD Recording which assists the user when recording from CD to tape. This function calculates and displays the length of tape necessary for recording automatically. If the last song on the first side is cut off midway, the song will be recorded in its entirety from the beginning of the second side.

The RQ-X10 personal stereo also has Super Extra Bass System, Tape Selector, Dolby B NR, one-key remote control and full logic auto-reverse playback.

For further information contact the Panasonic Customer Care Centre on (02) 132 600.





New 'Concept' components from Kenwood

Kenwood's new 'Concept' audio component line-up comprises three surround sound receivers, three AM/FM stereo receivers, four multi CD players and four double cassette decks, allowing tailoring of special 'Concept Packages' to suit individual needs.

Kenwood have focused on improving features throughout the range, and have included Dolby Pro-Logic surround sound and Digital Delay on all the surround sound receivers.

All surround sound receivers offer five channels of sound to recreate the realistic sound effects that Dolby Pro-Logic surround sound offers.

The top of the range KR-V8060 offers 100 watts for the front left and right channels, 100 watts for the centre channels and 20 watts for the rear surround sound channels.

The KR-V6060 offers five channels of surround sound amplification, 100W/channel front (stereo mode), 70W centre, and 20W/channel rear surround, while the KR-V5560 offers 70W/channel front, 70W centre, and 20W/channel rear surround.

The new Kenwood compact disc players include the DP-M5560 and DP-M3360, both 6+1 magazine types, and two five disc roulette compact disc players — the DP-R5060 and DP-R3060. All multi-disc players feature dual 1-bit D/A converter technology, CCRS (Computer Controlled CD Recording System), 20 track program memory banks and 20 track music calendar.

All Kenwood 'Concept' products are covered by a three year parts and labour warranty (laser pick-up 12 months) and are available at Kenwood specialist dealers. ❖

PHILIPS CDI 210 INTERACTIVE CD PLAYER

This month, Louis Challis has been able to cast his critical eye over an advance sample of the Philips CD-i/Digital Video CD player, complete with the Video CD plug-in module and a selection of software. Philips isn't planning to release the players and software in the Australian consumer market until around March next year, but very kindly made these advance samples available so we could give you a preview. We think you'll find it of great interest...

Most of us are intrigued by repeated references in the technical and general press, and even by politicians in Parliament, to the attributes of the coming 'information superhighway'. Each of us has a different perception as to what form that highway will take, and more pointedly, what information it will supply.

It should be obvious by now that the politicians, being politicians, don't know what they are talking about — but talk about the 'information super highway' because it creates an image of perception, understanding and forward thinking. Alas, nothing could be further from the truth. Even the manufacturers differ widely in their perception of what form the 'information super highway' will take, and one could be forgiven for having the impression that many of their ideas are equally 'wild and woolly'.

Philips, the inventors of the CD concept from the word 'dot', foresaw that CD's could be used not just for audio, but subsequently extended into other domains — including video. Twelve years ago they produced the first conventional audio CDs. Within two years, they had released CD videos (better known as CDVs). CDVs were followed by CD-ROMs, and most recently by CD Interactive (or CD-i).

CD-ROMs and CD-i are basic stepping stones at the start of the 'information super highway'. There is a clear overlap between CD-ROMs, which are intended to be used in computers, and CD-i for which you have to purchase a special purpose CD player. As always, the viability of any new hardware system is determined by the quality and available range of software for that system.

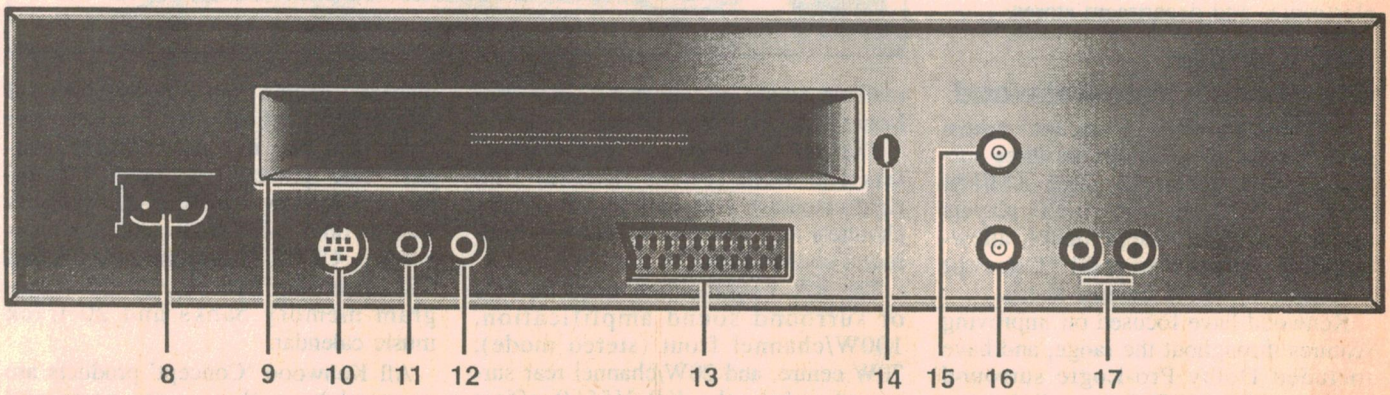
In the five years since CD-ROMs were first released, there have been many thousands of discs produced, the majority of which were produced for special technical and legal purposes, and to serve the purposes of special user groups. The special purpose CD-ROM discs have been matched by innovative and exciting educational software. The bulk of that software is the result of brilliant programming, which is worthy of your examination at your local computer shop.

The underlying concept of CD-i is that the user will not need to purchase a computer, but will use a special purpose CD-i player with a joystick or mouse control, together with the existing TV set or TV monitor in the home. Philips' research lead them to the conclusion that Mr and Mrs Average would not necessarily have a computer at home. In the event that there *was* a computer at home, many parents would be unwilling to let their children play with it, if it was also a repository of other critical information.

Philips saw other professional and consumer related uses for CD-i. These included special educational training, and specifically their use in schools. Another exciting option was their use for delivering specialised (tourist type) information systems. There are now thousands of CD-i players in use in commercial training systems, and thousands more in the field in tourist venues and in large retail malls, providing 'point of sale' information.

This was the genesis for the concept of CD-i, and Philips came to the view that young children, elderly people, and a significant proportion of adults in the middle, would be discouraged — if not completely put off — by the concept of a keyboard, a computer and a CD-ROM drive as the essential elements required for *their* entry to the 'information super highway'.

As with any new system of this type, the concept is only as attractive as the quality and diversity of the software. Because of the diversity in taste of the prospective market, in order for the system to be attractive, the software has to satisfy the lowest, the highest, as well as the common



The most obvious feature at the rear of the player is the large rectangular slot in the centre (9), to take the MPEG-1 Digital Video cartridge. Other items are the mains input (8), a serial I/O port for a mouse or serial connection (10), a composite video output (12), SCART connector (13), stereo/audio outputs (17), and RF in and out connectors (15, 16).



denominator in the market place. That as I have discovered constitutes a rather onerous task, and presents the promoter with innumerable problems.

When Philips first released the CD-i players in America and Europe some two years ago, although there was considerable 'fanfare' the hopeful hoards of purchasers did not materialise.

In the intervening two years, CD-i players have made slow but steady inroads into the consumer market of America and Europe, but at a much slower pace than had been hoped for. In order to offer the market what it really wants, the latest Philips CD-i players offer a number of improvements over the first generation players. The most significant of those bonuses are:

1. The new generation CD-i players will also display Photo CD's.
2. They also play digital video movies, with approximately 74 minutes of video per disc.

When it was suggested that I should review the latest Philips model CDI 210 player, I accepted the offer without hesitation. Some seven years previously, I had examined an ancestor of this system at the Matsushita Museum of Science and Technology in Osaka, and was immediately impressed with the future potential of the basic system. I was most intrigued by what I saw then in Osaka, and that quiet excitement is still there now.

Familiar, but different

Apart from the bold sticker in white and red which says 'Philips CD-i/NEW' on the front panel of the Philips model 210 CD-i player, one could be forgiven for confusing the player with any other CD player on the market.

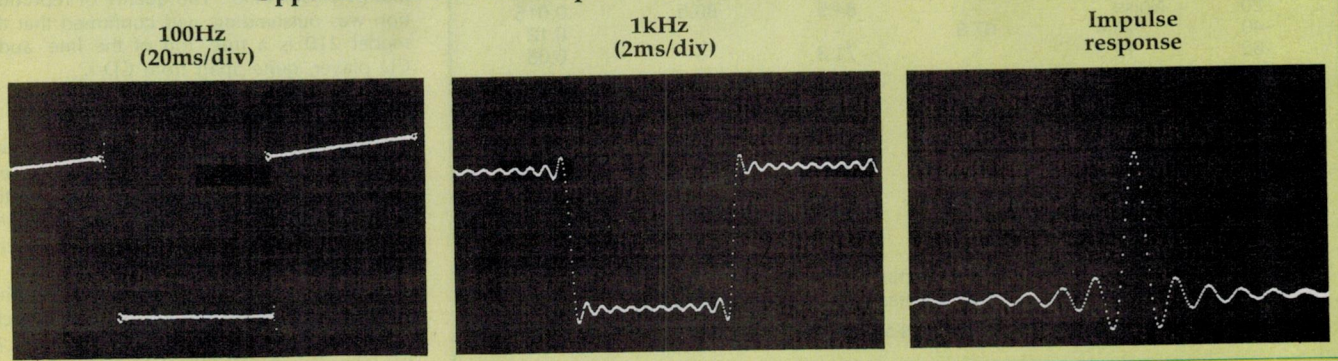
The only other clues available to you are the presence of a miniature DIN socket on the right hand lower corner of the front panel. On the rear panel you immediately notice an 'Audio/Visual Euroconnector' (or SCART socket) together with a second miniature DIN socket labelled 'INPUT 2'. That 'INPUT 2' is an RS-232 serial data port, which facilitates the interconnection of the CD-i player to your computer should you wish to extract graphics or audio.

If you can't use the audio-visual SCART socket, then the player also has a colour coded 'VIDEO RCA' type composite video output socket, two (stereo) audio output sockets and a separate colour coded 'REMOTE' input socket for use with the latest Philips audio-visual equipment control systems.

Right in the middle of the rear panel is a removable 'DIGITAL VIDEO CARTRIDGE'. This cartridge is classified as an 'MPEG-1', which incorporates a video processor, and related electronic circuitry. Philips are working on 'MPEG-2', which like the later, or latest generation of microprocessors in computers, offers the prospect of higher speeds and other functional advances, details of which Philips are currently keeping relatively close to their chest.

Philips were kind enough to provide a

Philips Interactive CD Player Model No. CDI 210
(for 90dB steady state SPI at 1m on axis)
Upper trace is electrical input — Lower trace is loudspeaker output



box of 20 CD-i software discs with the player, covering a wide spectrum of possible interests. At one end were a series of computer games. At the other were educational discs like 'A Child is Born' and 'The Renaissance of Florence'. The software that I would classify as 'middle market tastes' were typified by 'A Visit to Sesame Street — Numbers' and 'The Joy of Sex'.

Objective tests

As the model 210 CD-i player is also designed to satisfy your prospective requirements as a conventional audio CD player, I decided to evaluate its objective CD player performance.

I soon discovered that this single-bit CD player has a mighty impressive performance, with a frequency response that is virtually ruler flat from 20Hz to 20kHz and a digital to analog conversion linearity which has minuscule non-linearity all the way down to -80dB.

The channel separation figures were exemplary, and the player produced insignificant distortion at all levels down to -70dB or lower. The signal to noise ratio characteristics with and without emphasis are superb at 96dB(A), as is the frequency accuracy.

I decided to measure the 'fade to noise' characteristics of the player, using a fade to noise signal which starts at -60dB. As you will observe, the linearity is excellent down to -90dB. At -95dB, noise within the narrow passband of the selective filter produces significant curvature. However those noise components are so low in level that they would be unlikely to cause you any problems whatsoever.

I also examined the squarewave and impulse response of the model CD-i 210 in the CD player mode, and was again impressed by the 'textbook performance' that it displayed.

PHILIPS INTERACTIVE CD PLAYER MODEL NO. CDI 210

Serial No. 035210 (AH01 9415 000780) incorporating MPEG-1 Cartridge

1. Frequency response — 20Hz to 20kHz +/- 0.1dB

2. CD player linearity

Nominal level	Left output	Right output
0dB	0.0	0.0
-1.0	-1.0	-1.0
-3.0	-3.0	-3.0
-6.0	-6.0	-6.0
-10.0	-10.0	-10.0
-20.0	-20.0	-20.0
-30.0	-30.1	-30.0
-40.0	-40.0	-40.0
-50.0	-50.1	-50.0
-60.0	-60.2	-60.1
-70.0	-70.1	-70.1
-80.0	-80.6	-80.6
-90.0	-89.2	-89.7

3. Channel separation

Frequency	Right into Left dB	Left into Right dB
100Hz	85.3	84.8
1kHz	108.0	104.8
10kHz	99.2	110.2
20kHz	91.8	91.7

4. Distortion @ 1kHz

Signal	2nd	3rd	4th	5th	THD %
0	101.5	97.9	100.9	103.0	0.004
-1.0	103.4	97.2	101.4	102.6	0.004
-3.0	101.3	98.8	99.2	103.2	0.004
-6.0	103.8	100.1	106.2	104.5	0.003
-10	103.6	98.3	100.0	98.0	0.004
-20	97.9	91.6	86.3	98.2	0.01
-30	88.3	84.5	82.2	82.2	0.023
-40	75.6	71.9	69.6	70.7	0.09
-50	55.3	53.6	48.9	50.7	0.95
-60		In	Noise		
-70	45.2	40.7	-	40.6	1.42
-80	-	29.9	37.4	32.1	4.3
-90	-	27.4	24.5	14.2	20.8
Distortion @100Hz					
0	101.4	105.9	108.6	114.2	0.003
-20	Noise	-	84.9	80.5	0.016
-40	70.4	67.8	-	-	0.12
-60	72.3	-	71.3	-	0.08
Distortion @6.3kHz					
0	93.1	85.8	78.4	-	0.02

5. Emphasis

Frequency	Recorded Level	Output Level (L)	Output Level (R)
1kHz	-0.37	-0.3	-0.3
5kHz	-4.53	-5.0	-5.0
16kHz	-9.04	-10.3	-10.3

6. Signal to noise ratio — Without emphasis 83.6 (Lin) 96.0dB(A); With emphasis 84.2 (Lin) 96.0dB(A)

7. Frequency accuracy — 20kHz test signal - + 0.2Hz high

Listening tests

I played a number of new demonstration discs, including Telarc's 'The Great Fantasy Adventure Album' with Erich Kunzel and the Cincinnati Pops Orchestra (CD-80342), which contains fantastic music interspersed with positively dangerous sounds which could destroy your loudspeakers if you weren't cautious. I also played a far more attractive disc entitled 'Side by Side', with Itzhak Perlman on violin, and the equally famous Oscar Peterson on piano (Telarc CD-83341).

I progressed on to classical music, with a new release of Vladimir Horowitz 'The Complete Masterworks Recordings 1962 - 1973'. When Horowitz returned to public life from a self-imposed exile in the early 60's, CBS initiated extensive studio recordings.

He produced some of his most outstanding recordings around 1962 and 1963. Some of the best of that material has been reprocessed from the original tapes, using the latest in noise reduction equipment. Sony have reprocessed the original tapes to produce a set of CD's (S2K53457), which make use of the Super Bit Mapping process and 20-bit technology. The discs faithfully recreate Horowitz's studio recitals of 32 years ago with excellent fidelity.

I have always been a Horowitz fan, but these complete Masterworks Recordings now provide a new perspective, if not a new dimension on his abilities and his prowess. When Vladimir Horowitz plays, even if you are not a pianist yourself, you cannot help to be impressed as he has been described by others as being 'The greatest classical pianist of our time'. The quality of reproduction was outstanding, and confirmed that the model 210 is a true 'top of the line' audio CD player, quite apart from CD-i.

Video test discs?

I decided to ask Philips for special test software with which I could objectively evaluate its video performance. I asked the liaison engineers at Philips if I could possibly borrow a CD-i video test disc, but alas no such disc is available as yet.

In fact there didn't seem to be anything readily available at present to allow a technical evaluation of the video performance of the player with its MPEG-1 module — un-

less one is prepared to invest in the 'Green Book', which Philips make available for CD-i licensees. As this would have cost around $15,000, I decided that I'd have to find an alternative means of evaluating the video performance for this review!

I dug into the box of CD-i discs they'd supplied, and because my grand-daughter was visiting, drew out the 'Visit to Sesame Street — Numbers' CD-i disc, and then the 'Cartoon Jukebox' CD-i disc. My grand-daughter was enthralled by both discs, and each time she returned to my house, she unabashedly asked to view them again.

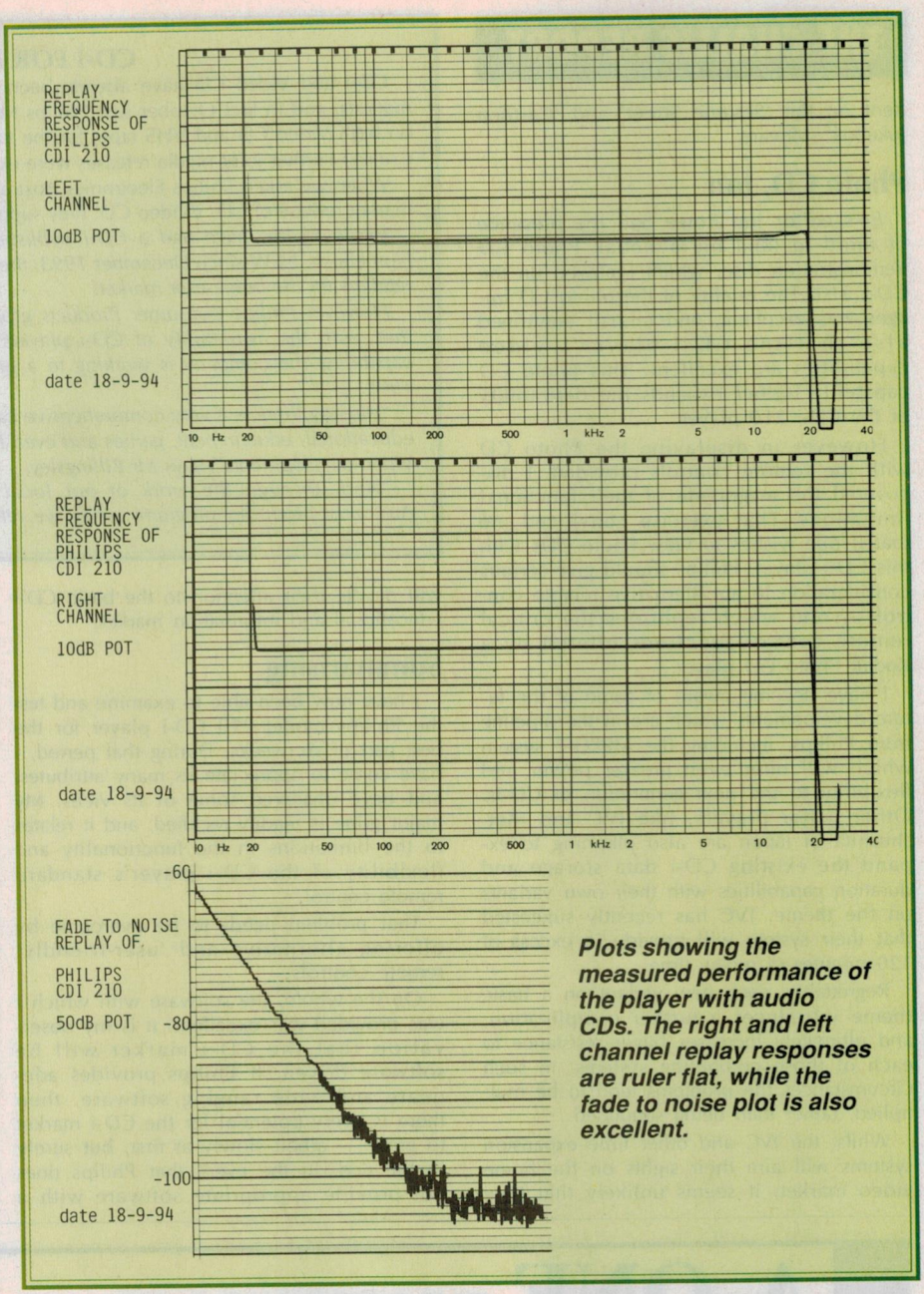
Here was my first confirmation that CD-i can, and will satisfy young children's tastes. More pointedly, the discs are pre-programmed to work in three different languages.

However the thumbpad remote control handset was ill-suited to a child's use, and frankly as an adult I experienced the same sort of problems as she did. Fortunately, Philips had included an optional accessory the model '22ER9017 Touchpad' (which provides full joystick control), and this initially satisfied virtually all our requirements.

I did observe, however, that the visual resolution of the 'Sesame Street' and 'Cartoon Jukebox' material did not even approach NTSC resolution, let alone PAL TV resolution.

That night whilst we were out, my youngest son discovered what was sitting in the living room and decided to view 'The Joy of Sex' CD-i disc, produced by a doctor with the appropriate name of Alex Comfort M.B. D.Sc. I knew that my son had viewed the disc, but what I did not realise (until some two weeks later) was that Philips had cleverly incorporated what proved to be a 'foolproof PIN number' system, so that parents can inhibit unauthorised children's viewing of such software.

On this occasion however, the tables had been inadvertently reversed. I discovered that my son had deftly obstructed his parents from viewing the CD-i, which I suspect he may have thought required an inverse 'parental guidance'. This was most certainly one important feature to which neither the CD-i 210's handbook, nor the information provided with the CD-i software, alluded...



Plots showing the measured performance of the player with audio CDs. The right and left channel replay responses are ruler flat, while the fade to noise plot is also excellent.

CD-i's true forte

During this two week period, I discovered what I believe is the true forte of CD-i. Firstly, I examined the CD-i 'Treasures of the Smithsonian' — which is interesting, but which I would not classify as being outstanding. I progressed to 'The Renaissance of Florence', which is excellent and bordering on outstanding. I visited Florence some years ago, and now wish that I could have viewed this CD-i before I made that visit.

By the way, I noted that the picture resolution on these educational films was far better than I had observed on the Sesame Street or Cartoon Jukebox discs.

Some days later, I mentioned to my eldest son that I had a CD-i entitled 'A Child is Born'. He then asked the question "Were its photos produced by Lennart Nilsson?" I said "hang on a second, I'll have a look!" On examining the back of the disc, I discovered that Lennart Nilsson had indeed provided most of the exquisite and mind boggling photography, which forms the very basis of this disc.

His response was, "Well you can't afford *not* to view that disc, as it is the result of more than 20 years of dedicated research, and I consider it a must!"

Without hesitation, my wife and I then viewed the CD-i. We soon discovered that although this CD-i may well have been produced with the purpose of providing children's sex education, it is nonetheless an outstanding example of educational interactive video-graphics.

More pointedly, it has been produced with a sensible and intelligent format which has convinced me that there is a place reserved for CD-i. I also formed the view that CD-i will only achieve full market penetration if the promoters are prepared to provide appropriate and innovative software.

I briefly examined some of the other software in the box, including 'A Guide to Sailboating and Seamanship', but skipped past discs with titles like 'Voyeur Don't Get Caught', 'Space Ace' and 'Kether', which cater for a different genre. I viewed some 20 minutes or so of the two-disc set 'Star Trek: The Undiscovered Country' and soon discovered why this and other episodes of 'Star Trek' had made it such a popular video series.

If these 'Star Trek' videos had used the CDV format, they would have been limited to less than 25 minutes of video. Instead Philips have been able to increase that video content to up to 70 minutes per disc, by adopting a data compression system — whose impact I could not readily detect on the 'Star Trek' discs. By contrast, that video compression algorithm was disturbingly evi-

dent on the 'Sesame Street' and 'Cartoon Jukebox' software.

Photo CD, too

EA's editor Jim Rowe had the presence of mind to lend me a Kodak Photo CD demonstration disc, which I played on the CD-i 210. The quality of the photo CD images was excellent, and in part confirmed also that the CD-i player's video capabilities are excellent. This photo CD capability further expands the desirability of the CD-i 210 player.

However in displaying the Photo CD with the remote controls provided, I discovered the magnitude of their functional limitations. That exercise convinced me that if one wishes to view Photo CDs with this CD-i player, Philips should give serious consideration to an alternative remote control — one which replicates the critical remote control functions offered by a Kodak Photo CD player.

I have become aware of some of the future developments which are in the pipeline from Philips, including the MPEG-2 system which will offer even greater power and flexibility to the next generation of CD-is. Other major players, like JVC and Matshushita of Japan are also planning to expand the existing CD-i data storage and duration capabilities with their own variants on the theme. JVC has recently suggested that their system will provide in excess of 120 minutes of replay time.

Regrettably, each new variant on a basic theme introduces a further complication, and ultimately increases buyer resistance to each of those competing systems. In such circumstances the problems tend to be multiplied, rather than being simplified.

Whilst the JVC and other time expansion systems will aim their sights on the home video market, it seems unlikely that they will devote their attention to the basic CD-i educational and information market.

Summarising

I have now been able to examine and test the Philips model 210 CD-i player for the best part of six weeks. During that period, I have come to appreciate its many attributes, and have observed some of its vices. My major gripe is readily rectified, and it relates to the limitations in the functionality and flexibility of the CD-i player's standard remote control.

That problem needs to be overcome by offering alternative and 'user-friendly' remote controls.

On the whole, the software with which I was provided was excellent. It is my observation that the CD-i market will be software driven. If Philips provides adequate and wide ranging software, then there is every potential for the CD-i market to grow — albeit slowly at first, but surely in the end. In the event that Philips does not provide appropriate software with a suitable distribution to satisfy all tastes, then CD-i will emulate the market penetration of DCC and Mini Disc.

One of the more critical pieces of information which both you and I will seek, is at what price this exciting software will sell. If the price is sensible, then I foretell a great future for CD-i.

However if the price is too high, then CD-i will become just another toy for elitists, with minimal market penetration. This is one aspect of the development which warrants a steady hand and a firm heart. It will be interesting to see who holds the tiller, and what course will be set.

The expected RRP for the CD 210 CD-i Player itself is $1150, plus a further $550 for the optional MPEG-1 Digital Video Module. The player's dimensions are 420 x 300 x 92mm, and it weighs 5.2kg.

Philips plan the Australian release of its CD-i hardware and software for around March next year. Our thanks to Philips Consumer Electronics for allowing us to provide you with this timely preview. ❖

CD-I FOR AUSTRALIA

CD-i and Video CD have already been released on the US and European consumer markets, and in fact October saw Philips Media in the USA release a film simultaneously on both Video CD and VHS tape, for the first time. (The film was *The Firm*, starring Tom Cruise.) Further joint-media releases were expected before the end of the year.

When we asked Philips Electronics Australia for information on the Australian consumer market release of CD- i/Video CD, they supplied this statement:

While Philips have had a CD-i publishers and professional users' Support Centre at Homebush, NSW since December 1993, the company has not yet supplied CD-i players to retailers for the home-user market.

However Philips Consumer Products group general manager Geoff Billingsley advises that, with the availability of CD-i players with inbuilt or optional-extra Digital Video capability, the company is working to a general market release for CD-i around March 1995.

"Already there is a very comprehensive catalog of titles for the general market — family educational, edutainment, games and even full-length movies, thanks to the recent Digital Video developments", says Mr Billingsley.

"And, through the work of our local CD-i Support Centre, there will even be Australian-produced programs when we release."

A-ONE ELECTRONICS PTY LTD
432-434 KENT STREET, SYDNEY N.S.W. 2000 Tel: (02) 267 4819 or 267 4820 Fax: (02) 267 4821

THANK YOU FOR YOUR SUPPORT.
SINCE LAST MONTH WE HAVE HAD A HUGE RESPONSE TO OUR SALE OF ELECTRONIC KITS AND MODULES. A FEW ITEMS ARE SOLD OUT, (NOT SURPRISING AT THE DISCOUNTS THAT WE OFFER), BUT WE STILL HAVE MANY OTHER ITEMS TO CLEAR. MAIL OR FAX YOUR ORDERS AS SOON AS POSSIBLE.

25% TO 50% REDUCTIONS, ALL STOCK TO CLEAR

Please send me a list of your sale items.
Name:
Phone:()
Address:
..... P/C:
Any specific items?
.....

READER INFO NO. 4

RADIO COMMUNICATIONS & GENERAL PURPOSE TEST EQUIPMENT SALE

- Digital Storage CRO HP 54111D, 2 Channel, 2 Giga Samples/Sec, 500 Mhz Bandwidth, 8Kb Memory, in excellent condition.
- Communication Service Monitors including - MARCONI 2955/A/B; IFR 500, 1000S, 1200S; MOTOROLA 2200, 2400; SYSTRON DONNER.
- Spectrum Analysers; CRO's; Signal Generators; Power Supplies.
- RFI Screened Rooms, 8ft x 4ft, S100 and 8ft x 8ft, S200.

All equipment used, calibrated and in very good condition.
NATA calibration available. SURPLUS EQUIPMENT BOUGHT.
SALES, SERVICE, REPAIRS & CALIBRATION OF COMMUNICATION EQUIPMENT AND INSTRUMENTATION TO THE ELECTRONICS INDUSTRY IN GENERAL.

CONSULTEC ELECTRONICS

83 Flinders Street, Mentone VIC 3194
PO BOX 1161, South Melbourne VIC 3205
Ph: (03) 585 1159 Fax: (03) 584 1169 Mobile: 018 033 573

READER INFO NO. 23

MULTIPLE SCLEROSIS CAN DISRUPT THE SMOOTH FLOW OF MESSAGES
(The smooth flow of messages from the brain)

For more information on Multiple Sclerosis and its symptoms call the Multiple Sclerosis Society in your State. MS

ARE YOU THINKING OF STARTING A SMALL BUSINESS?

AUSTRALIAN PUBLICATION

Running a small business these days requires more than just dedication and honest hard work. You need to be everything from the sales manager to the financial controller. What's more, you're expected to be an authority on all sorts of complex issues ranging from taxation to business law, superannuation to accounting and everything else in between. In short, it requires a great deal of knowledge on a broad range of subjects and you're going to need all the help and advice you can get.
This is where ***Australian Small Business & Investing*** (ASBI) magazine can help.

Published monthly, ASBI is crammed with ideas and information designed to help in the running of your business. Each issue contains practical advice written by small business people and advisers with first hand experience. It includes reviews of the latest office equipment, sales and marketing techniques, accounting and tax advice, promotional ideas and ways to help improve your bottom line.
Have ASBI delivered each month to your office or home.

A yearly subscription (12 issues) costs $53 (a 10% discount off the cover price, covering all postage and handling costs).

To subscribe call TOLL FREE 008 800 933 with your credit details ready or send your payment (cheque, credit card or money order) to:
Australian Small Business & Investing,
Subscriptions Department, Federal Publishing Company, P.O. Box 199, Alexandria, NSW 2015

ASBI0001

Update on a key 'data superhighway' technology:

ATM: MOVING VOICE, VIDEO & DATA AT VERY HIGH SPEED

There's now no doubt whatever that in the future, more and more people will be wanting to transmit and receive not only voice information, but also video, static images and computer data over long distances and at high speed. To allow this to be achieved efficiently over the integrated communications network of the future, a new technology is emerging: ATM. Here's a look at what ATM is, and how it works.

by ROBERT OWEN

Over the years, voice and data communications networks have followed very different development paths. The main attraction of the voice network has been the ability for a customer to connect to any other customer in the world. Thus, a focus of the telephone network operator has been to connect as many customers as possible to the voice network. Indeed, in the advanced countries of the world, almost 100% of their population now has ready access to a telephone.

The development of data networks, however, has been driven by far different requirements. Initially, private networks were installed to connect dumb terminals to a mainframe computer in the same building. Later, employees located many miles away needed to connect terminals to the mainframe back at head office. Thus began the use of the voice network to connect terminals to computers, using modems.

In many ways, the use of the voice network to transmit both voice and computer data are incompatible requirements and, as data communications became more widespread, specialised data networks such as LANs, WANs and the Austpac X.25 network began to appear.

Recently there has been a spectacular growth in the use of high speed data communications, and with multi-media and video transmission appearing on the horizon, existing transmission technology is being stretched beyond its limits. Both telecommunications network

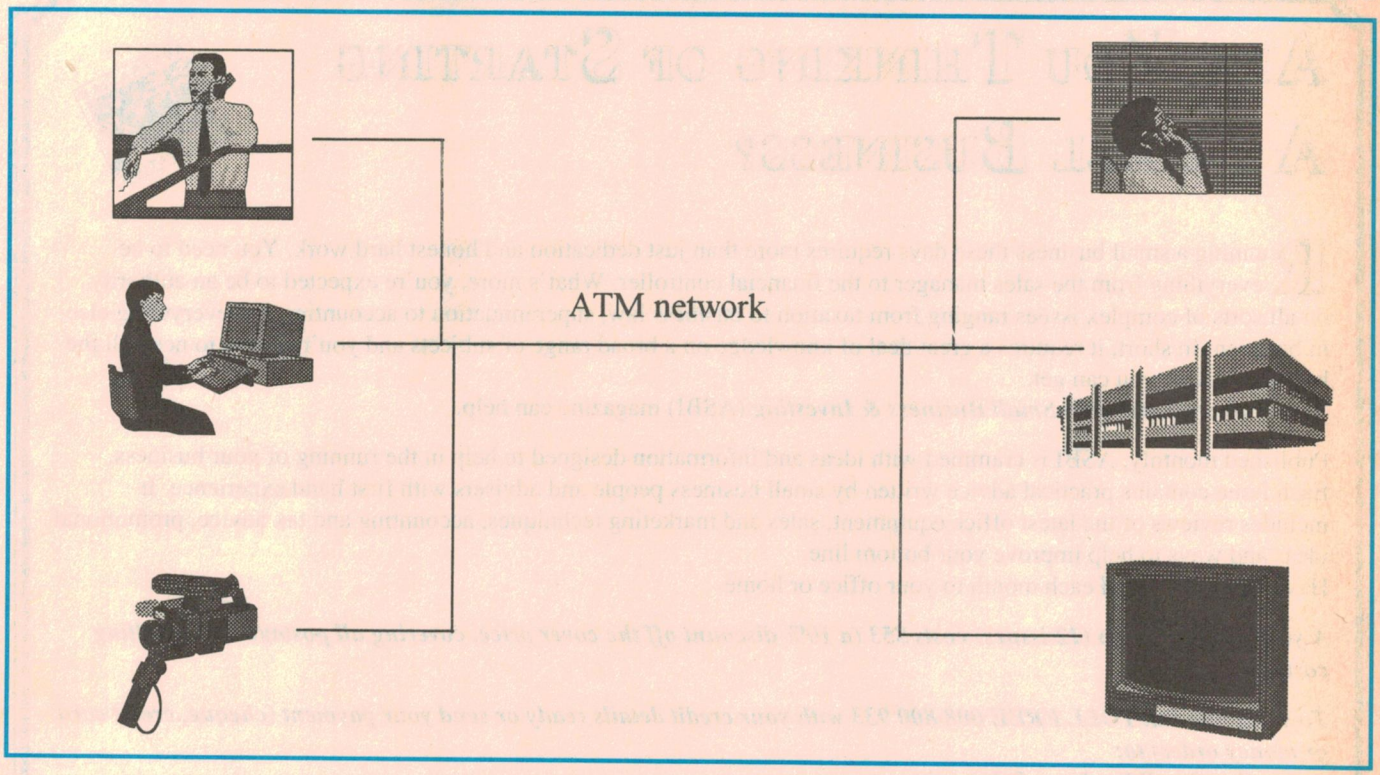


Fig.1: ATM can be used for all voice, data and video applications, combining multiple overlay networks into a single integrated communications network.

operators and LAN and WAN equipment suppliers soon came to the conclusion that a new generation of transmission technology would be needed if future requirements were to be met.

This new technology would have to transmit not only voice, but data and video as well, if the aim of a single universal network handling all the communications needs of a customer were to be met. Also, the new technology would not only need to be applicable to the public telecommunications network, but also be suitable for LANs and WANs and every other communications method that would develop.

The technique that was chosen came to be called the *Asynchronous Transfer Method*, or ATM for short. ATM is sometimes called Broadband ISDN, or just B-ISDN.

By using ATM for all data and voice applications, both in public and private networks, a single voice and data communications network can be developed that eliminates the inefficiencies involved in operating separate networks (see Fig.1).

Today, most commercial organisations use a PABX for telephone calls and a LAN for data. In future, because both voice, data and video will be transmitted using ATM, equipment such as PABXs, LANs, WANs and video servers will merge into a single communications server, handling all the communications needs of a company. Such products are already being planned.

Increasing efficiency

Before discussing how ATM works, let's first understand why using dedicated circuits for data and voice is inefficient.

When, say, a data call is established using the conventional telephone network, two dedicated paths are reserved for the duration of the call. One path is used to transmit data from the PC to the mainframe, while the other path is used to transmit data from the mainframe back to the PC. Studies have shown that during an average data call, data is only transmitted for a small portion of the time that the call is made. Thus, both of the two paths are left idle for most of the time, which is very wasteful of transmission capacity.

If instead we could find a way to take advantage of the silent periods to transmit computer data from several callers along the same transmission path, then a much more efficient use of the telephone network could be obtained. Also, we want a way to send this data so that on each leg of its transmission, data from one user could be sharing transmission bandwidth with data from other users going to completely different destinations. How can we do this?

The way that ATM does it is to first break up each message into small segments. For example, the message 'THIS MESSAGE IS TOO LONG' is first divided into shorter sequences of — say — six characters; e.g., 'THIS M', 'ESSAGE', ' IS TO' and 'O LONG'. At the start of every group of six letters a *header* is attached, giving the address to which it is to be sent (see diagram in the 'ATM Header Fields' data panel).

Because each group of characters has a header containing the exact address of its destination, it contains sufficient information for the network to route it. Each group of six characters is now called a *cell* and can be passed to the ATM network to be sent to its destination.

Although in the above example we split up the data into groups of six characters, ATM works by transmitting data in 53-octet cells — each made up of 48 octets of user data (sometimes called the payload) and a five-octet header containing an ad-

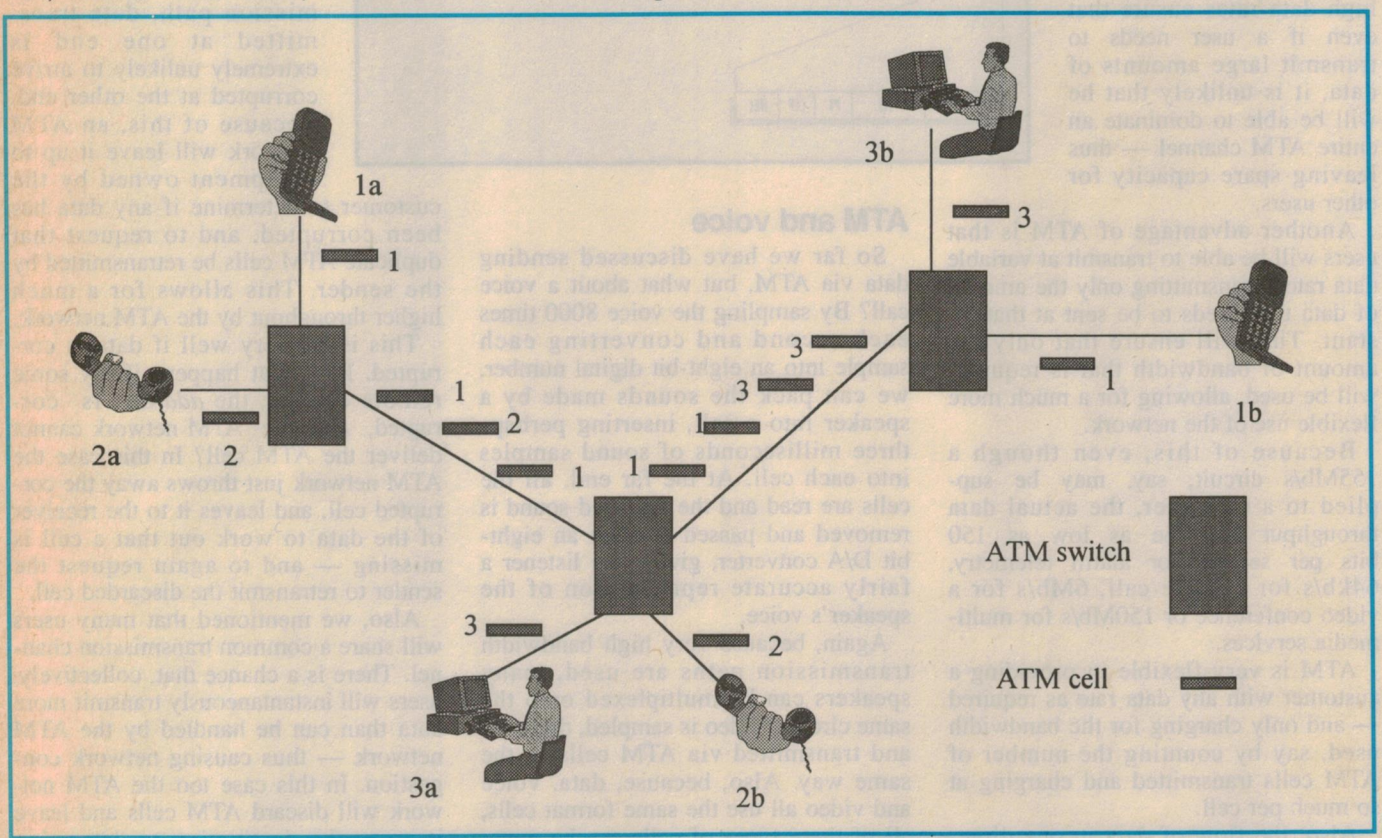


Fig.2: Because each ATM cell contains a unique address, many other cells from numerous other users can simultaneously share the same communications path. Voice, video and data cells can be interleaved as desired.

ATM: Moving voice, video & data at very high speed

dress and other control information. A long message would thus be broken down into 48-octet data segments for transmission, with a five-octet header being attached to each data segment before transmission. An octet consists of eight bits (often called a byte).

Because each cell contains an address, many other cells from many other users can share the same transmission path. This is because an ATM switch need only look at the header on each cell that arrives to decide how to route it (see Fig.2). Thus, the first cell that arrives could be routed to Sydney, the second cell could be routed to Darwin, the third cell could be routed to the USA and so on, without causing any confusion.

ATM uses very high bandwidth channels for transmission — 155Mb/s (megabits per second), 620Mb/s and 2.4Gb/s data rates are available or planned. These enormously high data rates ensure that even if a user needs to transmit large amounts of data, it is unlikely that he will be able to dominate an entire ATM channel — thus leaving spare capacity for other users.

Another advantage of ATM is that users will be able to transmit at variable data rates, transmitting only the amount of data that needs to be sent at that instant. This will ensure that only the amount of bandwidth that is required will be used, allowing for a much more flexible use of the network.

Because of this, even though a 155Mb/s circuit, say, may be supplied to a customer, the actual data throughput may be as low as 150 bits per second for alarm telemetry, 64kb/s for a voice call, 6Mb/s for a video conference or 150Mb/s for multimedia services.

ATM is very flexible in providing a customer with any data rate as required — and only charging for the bandwidth used, say by counting the number of ATM cells transmitted and charging at so much per cell.

Also, the flow of data in one direction can be significantly larger than the flow of data in the opposite direction — and the customer still only pays for the number of cells transmitted. As an example, consider a customer at home interrogating a database. The occasional command to query the database will not involve much data, but the information sent back from the data base could be considerable. This type of connection is called *asymmetric*.

ATM Header Fields

The fields used within the ATM header at the interface between the network and the customer's equipment are as follows:

GENERIC FLOW CONTROL (GFC): Used to control usage between several terminals using the same access connection.

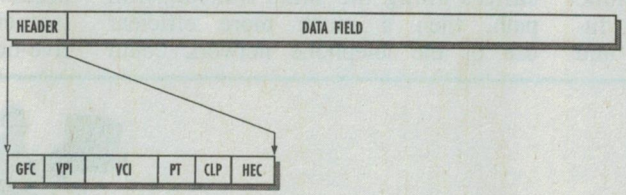
VIRTUAL PATH IDENTIFIER (VPI): A virtual path is a bundle of individual channels connecting two points in an ATM network.

VIRTUAL CHANNEL IDENTIFIER (VCI): Every connection in an ATM network is allocated a VCI number for the duration of the call.

PAYLOAD TYPE (PT): Used to define maintenance cells, congestion conditions and other types of cells.

CELL LOSS PRIORITY (CLP): There is always a slight risk that cells will be discarded by the network. Assigning a 'cell loss priority' to a cell tells the network that this cell is less important than other cells and can be discarded first.

HEADER ERROR CHECK (HEC): The final field in the header provides a checksum over the 5-octet header, to determine if the header has been corrupted.



ATM and voice

So far we have discussed sending data via ATM, but what about a voice call? By sampling the voice 8000 times each second and converting each sample into an eight-bit digital number, we can pack the sounds made by a speaker into a cell, inserting perhaps three milliseconds of sound samples into each cell. At the far end, all the cells are read and the digitised sound is removed and passed through an eight-bit D/A converter, giving the listener a fairly accurate reproduction of the speaker's voice.

Again, because very high bandwidth transmission paths are used, many speakers can be multiplexed onto the same circuit. Video is sampled, digitised and transmitted via ATM cells in the same way. Also, because, data, voice and video all use the same format cells, all of these types of calls can be transmitted together using the same ATM transmission network. This common use of a transmission network leads to the very efficient use of equipment and fibre-optic cable.

In the 1970's, when X.25 was being developed, the available transmission methods involved using either copper wire or coax cable and were so noisy that there was a good chance that data would be corrupted during transmission. Thus, one of the reasons that X.25 is so slow is that an X.25 network would constantly be performing error checking on transmitted data, to see if it had been corrupted by noise. If a corrupted X.25 packet were detected, the X.25 network would request that the packet be retransmitted. Only in this way could Telecom guarantee that an X.25 packet would be delivered by Austpac uncorrupted at its destination.

With the widespread introduction of fibre optics, however, all this has changed. Fibre-optic transmission is so reliable that no matter how long the transmission path, data transmitted at one end is extremely unlikely to arrive corrupted at the other end. Because of this, an ATM network will leave it up to equipment owned by the customer to determine if any data has been corrupted, and to request that duplicate ATM cells be retransmitted by the sender. This allows for a much higher throughput by the ATM network.

This is all very well if data is corrupted. But what happens if, by some remote chance, the *address* is corrupted, and the ATM network cannot deliver the ATM cell? In this case the ATM network just throws away the corrupted cell, and leaves it to the receiver of the data to work out that a cell is missing — and to again request the sender to retransmit the discarded cell.

Also, we mentioned that many users will share a common transmission channel. There is a chance that, collectively, users will instantaneously transmit more data than can be handled by the ATM network — thus causing network congestion. In this case too the ATM network will discard ATM cells and leave it up to the destination to determine which cells have been discarded and to request retransmission.

Of course, it is important that all cells containing computer data be received correctly, even if they have to be retransmitted. But if cells containing speech or video are discarded by the ATM network, they will not be re-transmitted. This is because if a voice cell is corrupted, the human ear will compensate for any noise. Also, if a video cell is corrupted, by the time the receiver has requested that a new cell be sent, the rest of the picture will have moved on, so the corrupted video cell is displayed — which adds only a small amount of noise to the picture.

Packets, frames & cells

Before going any further, I would like to explain the difference between a packet, a frame and a cell. Simplistically, the difference between a packet (as in X.25) and a frame (as in Frame Relay) is that packet is an old technology and involves the extensive use of error detecting at the end of each leg of transmission. Frames, on the other hand, were developed as part of ISDN and use very little error detecting because fibre optic transmission is virtually noise free.

Both packets and frames, however, have in common the use of *variable length data fields* so that users can send as little or as much data as required. As a disadvantage, because both packets and frames use variable length data fields, switching equipment must constantly be looking for the start *and end* of each packet or frame — in order to correctly route data. This requirement adds a lot to the complexity of packet- and frame-switching equipment.

ATM cells, on the other hand, use a *fixed length* data field, which always contains 48 octets of data and a five-octet header. Because cells are of fixed length, the complexity of ATM switching equipment can be reduced because the beginning and end of every cell is known in advance and does not vary from cell to cell.

Where ATM stands

The above discussion relates to the design of ATM networks, but at what stage today are ATM products?

Many LAN and WAN equipment vendors are today selling ATM products for use in private data networks. Thus, the use of ATM as a replacement for Token Ring and Ethernet is well under way.

For longer distances, Telecom are installing an Experimental Broadband Network that they will use to gain experience in running ATM over wide area data networks, inter-city data links and international communications with the USA and Japan. Based on the findings of the Experimental Broadband Network, it is expected that over the next few years Telecom will expand this network to cover all the major cities in Australia and provide ATM connections to other overseas countries.

At present, the use of ATM in Telecom's Experimental Broadband Network will be provided as an overlay on top of existing voice and data networks. As time goes on and the use of ATM to transmit both voice and data becomes widespread, many people believe that Australians will be connected to an ubiquitous ATM network that will handle all of a customer's communications needs. As cable based pay-TV becomes more widespread, the use of ATM to transmit digital TV signals will also become standard.

So far we have discussed ATM in the context of using fibre-optic links, but in the next 10 years radio communications is going to become far more widespread than it is today. Although radio LANs will undoubtedly use ATM in the near future, what about personal cellular radio communications?

If the existing analog AMPS cellular network is regarded as a first-generation radio technology, then digital GSM cellular radio uses second-generation technology (see 'AOTC's New Cellular Mobile Network' by Robert Owen, in *EA* for September and October 1992). Even though GSM technology is new and is only now being installed in countries around the world, cellular radio network designers are already planning a replacement for GSM digital cellular radio, which will be available early in the next century. One of the main contenders is the Future Public Land Mobile Telecommunications System, or FPLMTS for short,that is currently being standardised by the ITU in Geneva (ITU is the world coordinating body for telecommunications).

Although standardisation work on FPLMTS is still in its infancy, there is little doubt that third-generation radio systems will break away from dedicated channels being allocated to users, and will instead transmit data and voice using ATM and CDMA spread spectrum radio technology (see 'CDMA Spread Spectrum' by Jim Davies, in *EA* January 1993).

The above discussion gives an explanation of ATM and a whirlwind tour of its main applications. There is no doubt however that ATM will be a major transmission technology in the future and will be used in all areas of communications. ❖

GLOSSARY

Austpac: An Australian data communications network that uses X.25.
Ethernet: A data protocol used in Local Area Networks.
Frame Relay: A data standard defined as part of ISDN, which transmits variable lengths of data.
GSM: Global System for Mobile Communications, Australia's new digital cellular radio system.
Local Area Network (LAN): A data network used to connect terminals and mainframes over short distances, say within a building.
Multimedia: A high bandwidth service that transmits both voice and data at once.
Octet: A byte, or eight bits of data.
PABX: A Private Automatic Branch Exchange. Used to provide telephone service within a building, say.
Wide Area Network (WAN): A data network used to connect terminals and mainframes over relatively large distances, for example on a university campus.
X.25: A data network protocol designed in the 1970's. X.25 transmits variable lengths of data, unlike ATM which transmits fixed lengths of data.

KALEX
The UV People
ETCH TANKS
● Bubble Etch ● Circulating
LIGHT BOXES
● Portuvee 4 ● Portuvee 6
● Dual Level
TRIMMER
● Ideal
PCB DRILL
● Toyo HiSpeed
MATERIALS
● PC Board: Riston, Dynachem
● 3M Label/Panel Stock
● Dynamark: Metal, Plastic
* AUSTRALIA'S NO.1 STOCKIST *
KALEX
40 Wallis Ave, East Ivanhoe 3079.
Phone (03) 497 3422, Fax (03) 499 2381
READER INFO NO. 5

Bringing benchtop features into the palm of your hand.



These compact multimeters will perform as well as your bench meter, without emptying your pockets.

The HP-970 series of handheld multimeters offers the basics and a whole lot more. Start with dc/ac voltage, dc/ac current, ohms, frequency, continuity and diode tests - but don't stop there. Check out the high resolution temperature function (°F or °C), the auto diode feature that automatically reverses polarity when checking diode junctions, and the min/max feature that records elapsed time and alerts you when a min or max is recorded.

Pick up the HP 973A when you need accuracy and flexibility: 3½ digit display (with 0.1% basic dc accuracy), 20 kHz frequency response, true rms, and ac+dc let you measure nearly any waveform with confidence. When extra precision is required, the HP 974A's 4½ digit meter is as precise as you'll find, with a 49,999 count full scale. Measure low-level signals with the HP 972A. You'll appreciate 40mV ranges for dc/ac voltage and the assurance of 20 kHz frequency response. When things tend to get bumped and broken, there's no better handheld than the HP971A.

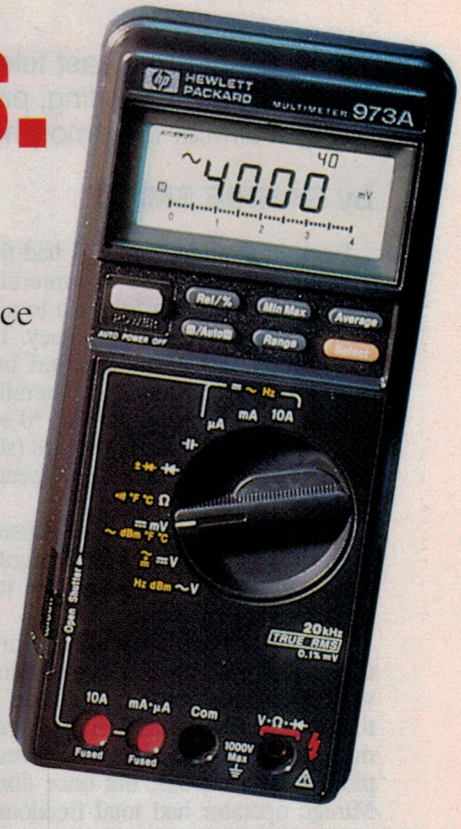
Use your new meter with confidence. The innovative safety shutter prevents accidental connection to the current terminals, and offers high-energy fuses and audible warnings for input overloads. We've taken care of the meters, so you can take care of your circuits.

So call our Customer Information Centre on **13 1347** (Australia wide) and ask for extension **2902** to receive your copy of HP's Basic Instruments Catalogue.

A better way.

HEWLETT® PACKARD

Subscribe and you could win one of 15 HP multimeters.



Subscribe or renew your subscription to Australia's top selling electronics magazine today, and we'll deliver to your home or office 12 issues for only $53 (which includes postage and handling charges) - that's a saving of 10% off the cover price.

Subscribe and you could be 1 of 15 lucky subscribers to win the HP 973A, the handheld multimeter that gives you all the features and performance that you need for bench and field measurements. Each meter is valued at $527 each.

Subscribe to *Electronics Australia* magazine with your credit card by calling TOLL FREE 008 800 933 - Sydney residents call (02) 353 9992. Or fill in the subscription card attached and send with your payment (cheque, money order or credit card details) to: Federal Publishing, Subscriptions Department, PO Box 199, Alexandria NSW 2015.

HURRY. OFFER ENDS 21 DECEMBER 1994

Any queries about your subscription?
Call our customer service line: (02) 353 9992

HOW TO ENTER: Simply phone our toll free number **008 800 933** and have your credit card details ready. If you do not have a credit card then fill out the subscription card attached and post. If the card is missing, send your name, address, phone number and cheque to: **Federal Publishing Company, Reply Paid No. 3, PO Box 199, Alexandria NSW 2015**. Any enquiries can be made by phoning (02) 353 9992. Unsigned orders can not be accepted.

CONDITIONS OF ENTRY: 1. The competition is only open to Australian residents authorising a new or renewed subscription to **ELECTRONICS AUSTRALIA** before last mail on 21.12.94 Entries received after closing date will not be included. Employees of the Hannan Group, Hewlett Packard, their subsidiaries and families are not eligible to enter. 2. South Australian residents need not purchase a subscription to enter, but may enter once by submitting their name, address and phone number to the Federal Publishing Company Pty. Ltd., PO Box 199, Alexandria NSW 2015. 3. Prizes are not transferable or exchangeable and may not be converted to cash. 4. The judge's decision is final and no correspondence will be entered into. 5. Description of the competition and instructions on how to enter form a part of the competition. 6. The competition commences 21.9.94 and closes last mail on 21.12.94 7. The draw will take place in Sydney on 3.1.95 at 11am and the winners will be announced in the March 95 issue of **ELECTRONICS AUSTRALIA** and notified by mail.. 8. The prize is; 15 x Hewlett Packard mulitimeters valued at $527 each. Total prize value $7905. 9. Subscriptions are not refundable. 10. The promoter is the Federal Publishing Company Pty. Ltd., 180 Bourke Rd, Alexandria NSW 2015. Permit No. TC94/0000 issued under the lotteries and Art Union Act 1901; Vic. Permit No. 94/0000 issued on 00/00/94; ACT permit no. TP94/0000 issued under the Lotteries Act 1964; NT permit No. 94/000.

Electronics AUSTRALIA

ELT/MUL/000 10,11,12/94

A leader in digital image manipulation:

QUANTEL ROLLS THE DIGITAL DOMINO

The 'look' of broadcast television has radically changed in the last 10 years, as a result of the introduction of digital editing, production and image manipulation systems. Now film production is undergoing a similar metamorphosis, thanks to firms like the English company Quantel.

by BARRIE SMITH

Back in the mid 1980's, I had the occasion to make a TV commercial by remote control, from SE Asia to a video post production house in Sydney. The ad required a three dimensional box of (ahem!) tampons to rotate laterally. As the box slowly rotated for the 30-second length of the spot, sundry scenes (shot on film) of athletic young ladies appeared on its sides.

To achieve this the 'post' house used the then-new Quantel Mirage digital effects unit — then uniquely able to perform such tricks.

The effect was created, not in 'real time', but by tediously pre-plotting the vectors of the box and its path and inputting the data; then the Mirage keyed the moving images onto the box faces. The plotting was tedious, but once done the Mirage operator had total freedom. The actual digital effects rendering took only a few hours.

In the 1990's, digital video effects hardware and software have now leaped to unbelievable heights in image manipulation, and in that area Quantel is perceived to be supreme. But more recently the company has also entered the field of high definition processing of motion picture images, with its Domino technology.

From weeks to minutes

Back in the 1950's, if you wanted to make a recorded commercial for television it had to be shot on film — usually 35mm black and white. The film's processing was (and still is) overnight; so you could view rushes, edit, create a sound track and get a final print out in one or two days. Quick, huh?

"Oh, the agency wants opticals and titles", blurts the producer. This 'small problem' I overcome by sending the negative out to an optical effects house, and then waiting six weeks for the combined optical negative to be returned. Six weeks!

Today, one of Quantel's digital 'post' (post processing) devices can scan into the system a processed 35mm colour negative, edit it, touch up individual frames, add titles, dissolve between scenes, chroma key the talent over Uluru, adjust the colour rendering, sync the sound track and output the final result to a D1 digital VTR — in real time.

Early pioneer

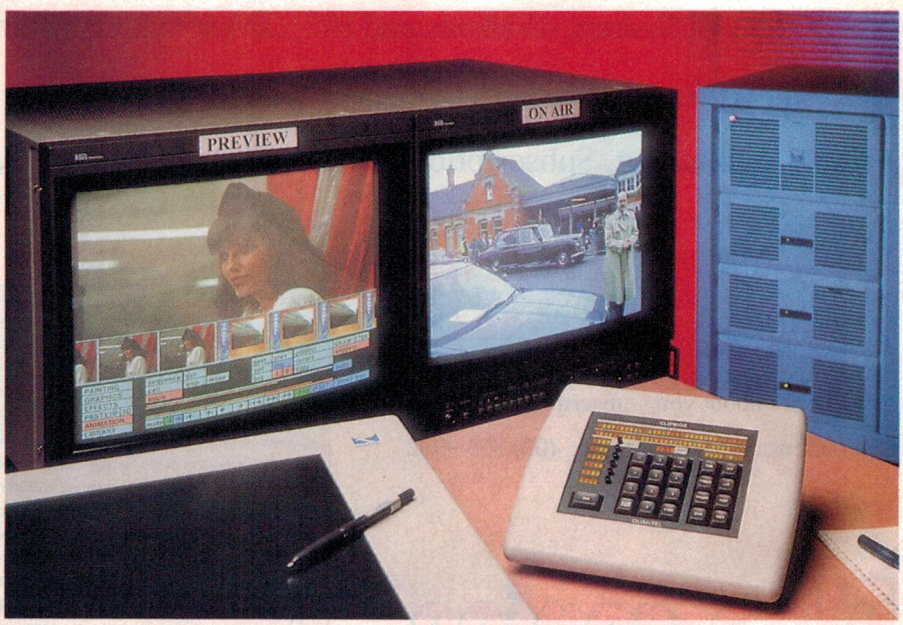
In the early 1970's, Quantel began to explore the application of digital technology in television, then an analog medium. Since then, the company has triggered three revolutions in television, as well as inspiring similar transformations in the graphics industries.

The first revolution began in 1976, when viewers of the Montreal Olympics were treated to the insetting of quarter screen-sized live pictures over the main action — made possible by Quantel's synchroniser/effects technology. Quantel then produced the world's first 'zoom' machine — the DPE 5000 — enabling a live picture to float around the screen. Today we call it PIP (picture in picture), and it's often found built into top of the range domestic TV sets.

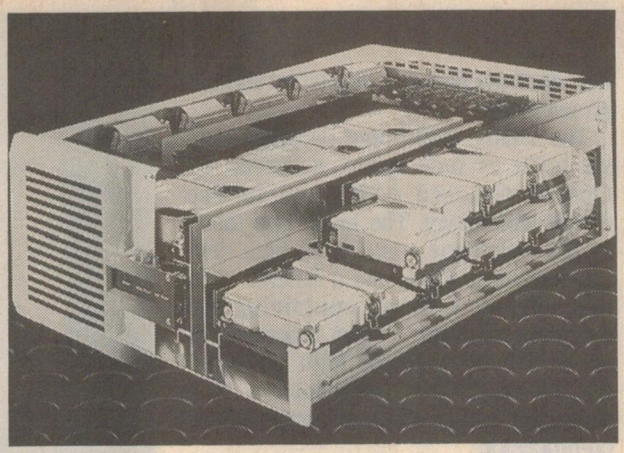
The first synchroniser allowed pictures from different sources to be locked together, allowing 'live' edits; one picture was 'held up' until it was in sync with a separate source. Both pictures were then scanned at the same moment.

Basically an A/D and D/A converter with a solid state framestore, it was all contained in a box only 222mm high. Competitive equipment at the time was based on shift registers and housed in a case 2.1m high, pulling the current of an average house.

Quantel's work in electronic picture



Quantel's Clipbox can hold up to 30 hours of CCIR 601 quality video images.



An array of 20 high density 3.5" SCSI hard disk drives. Dylan supplies high capacity random access storage to a number of Quantel devices. The drives are arranged in two layers of 10, each holding 7.5 minutes of video.

storage provided broadcasters with the means to save and handle large quantities of still pictures used in every day, on-air transmission — so causing the second revolution. The creation and alteration of these images became possible with Paintbox — today a universal electronic graphic design standard.

Part of Paintbox's secret is its intuitive control system, completely hiding the operator from the electronic complexities. This concept was extended to the editing of moving video in the mid 1980's, creating the third revolution with Harry — the world's first digital editing suite. At a stroke the generation loss of the editing phase in analog post production was overcome.

Richard Taylor, Quantel's MD at the time, addressed the inaugural Sydney SMPTE of 1984, expressing the company's design philosophy as one of "giving the creative designer the freedom to choose whatever shape and form suited him, rather than accept the fixed parameters chiselled in silicon by the engineers..." This led to the Mirage. Allowing each picture point to be individually addressable, the Mirage's circuitry processed multiple address folds: a scene could now turn like the page of a book, twist, become wrapped around a cylinder — and, since the machine could produce a 3D shape, these shapes could have a front and a back. The Mirage's address circuits actually became an address store.

THE AUSTRALIAN END

In terms of post production users of Quantel systems against broadcast operators, the ratio is 7 to 3. Top post companies find their client base of TV commercial makers often demand Quantel devices for their productions.

In this country Channel 9 and the ABC are major users of Quantel hardware. The latter operate a series of Paintboxes, Still Stores, a pair of Harriets and an Editbox across three states.

When asked whether we would see a Domino installation in this country in the next 12 months, Australian MD Haydn Deere confided there was "room for a Domino". Should any company be willing to adopt a system Quantel, as supplier would consider the installation as demanding 'an ongoing relationship' to extract the utmost from the technology. A close link with a film lab would be essential, Deere added.

New Zealand is active in acquiring the latest from the UK company, running a collection of Harrys and Paintboxes.

There are still four early-1980's Mirages running in Australia.

UK headquarters

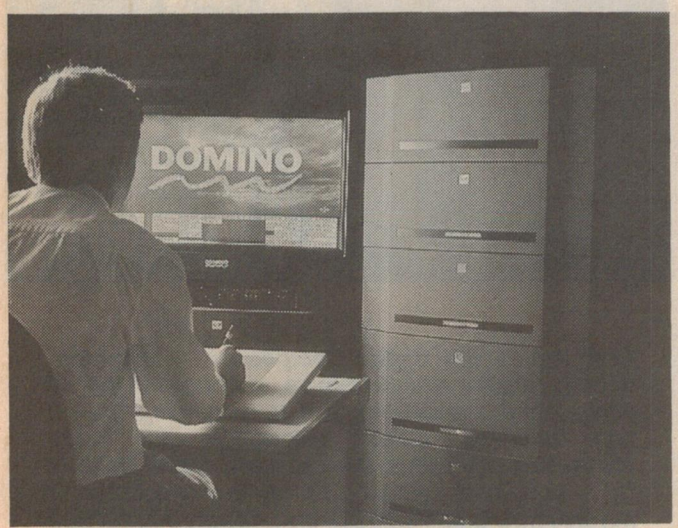
Quantel's 100,000 square foot plant and R&D labs are in Newberry, Berkshire, UK. The parent company is Carlton Communications, which controls the UK's largest independent TV broadcaster, plus Technicolor, Solid State Logic and Abekas — the latter also involved in digital processing.

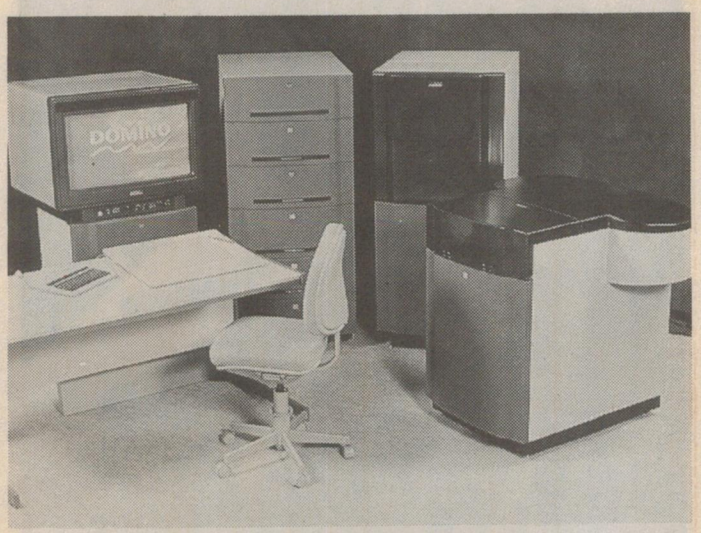
80% of the company's sales can be attributed to its 10 overseas branches. R&D consumes 15% of Quantel's annual turnover. The purpose-built laboratories house both development engineers and the drawing office, ensuring close liaison between design and manufacturing.

Project teams are kept deliberately small, typically four to six engineers. The company's R&D engineers maintain a close contact with equipment users, guaranteeing their research has relevance to 'real world' needs.

Quantel's philosophy decrees there be no artificial distinctions between hardware and software disciplines. Circuit and custom chip design is carried out on a network of CAD workstations, directly linked to drawing office CAD systems. Software compilation uses a mix of individual workstations and central mainframes.

The launch of a new system marks only the first phase of the company's development cycle; typical active product development life is seven years, with support continuing well beyond this. Many systems dating from the early





Moving film opticals into the digital domain is Domino — a system priced at two million pounds sterling.

Quantel rolls the Digital Domino

1980's are still in profitable service around the world.

Manufacturing...

With the exception of metalwork and PCB manufacture, almost every aspect of the manufacturing process is carried out in house. Just in Time stock control methods are employed, coupled with EDI (Electronic Data Interchange), a principle allowing automatic and instant re-ordering of parts — techniques prevalent in banks and supermarkets.

The entire manufacturing process is computerised, from the direct transfer of manufacturing data, automatic parts list generation/stores management to the control of automatic insertion machines, both conventional and surface mount. By the time the circuit boards and their crates come together in the Test Deptartment for final alignment and certification, every component has passed thorough CQ procedures, finally entering a TsoakingU stage, to simulate extreme climates.

Henry, Hal and friends

Since the 1980's a stream of devices has appeared from Quantel to satisfy the needs of not only the post industry, but broadcast professionals as well.

1992 saw Henry, a *concurrent* editor, appear. For the first time image multi-layering and random access, non-linear editing were combined in one 'box'. A single, totally integrated control system was run from pen, graphics tablet and on-screen menu.

The Henry mainframe occupies only six units of rack space, achieved by Quantel-designed ASICs and surface mount technology. The lower two thirds of the mainframe contains 16 high density multilayer cards and a 525MB rigid magnetic disk drive, containing the operating software. System processing is controlled by multiple high powered, dedicated CPU's, combined with a transputer acting as an advanced maths co-processor.

Linked to the mainframe are four pairs of 'Chatter' disk drives, able to offer random access storage of five minutes of contiguous video frames. Quantel's Chatter technology reinforces the disk interfaces with massive amounts of RAM, to create super fast, multi-channel random access disks. The result is an ability to process data at rates faster than the video frame rate. The Chatter disks perform all the functions of traditional VTR source decks, needing only an outboard D1 recording unit to capture the final signal.

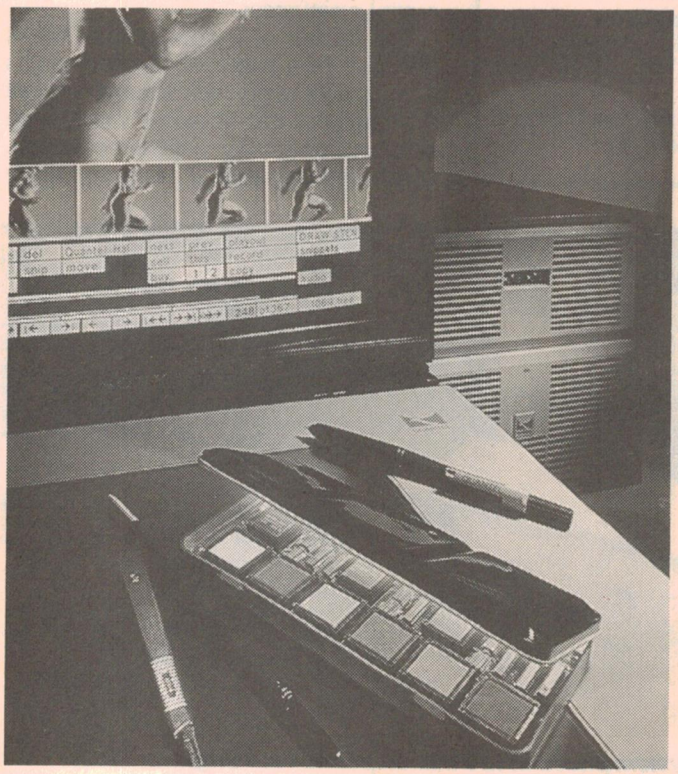
Henry uses timecode only as a reference to the 'outside world'. All video and sound 'clips' are retained within the system, thus preventing sync problems and allowing editing to be performed with pictures not numbers; however, original frames always retain their timecode.

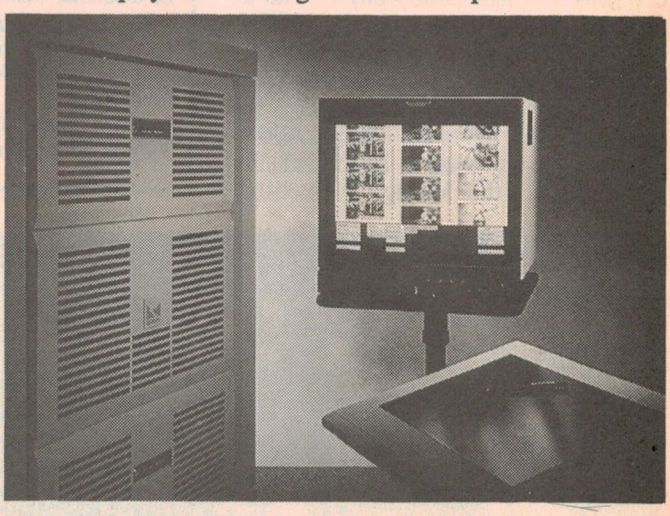
In editing mode, the operator is presented with an on-screen display of actual frames of the action; each clip, or group of frames, can be 'picked up' using the pen and 'attached' to another. An AES/EBU audio-for-video editor is incorporated, ensuring any edit to the video will produce a corresponding edit to the audio.

Previously determined EDL's (Edit Decision Lists) can be input to the system, or the editing process can be begun from scratch. On-screen scrolling at speed through clips is achieved by accessing VTR-like transport controls.



This impressive Dali-esque image was created by New York artist John C. Sicewiz on a Graphic Paintbox.





Left: Hal — the Digital Compositor — conducts editing, digital effects moves, chrome keying of scenes, image retouching and tracing, graphic and text creation, colour correction and audio processing, all within the one unit. Right: Editbox is a non-linear digital edit suite. Two integral keyers and Digital Video Effects units are augmented by a multi channel audio module.

Such trickery as 'stretching' or shortening the screen action, reversing and 'layering' can be achieved with the pen/tablet interface. A Blender mode allows each of six layers and any requisite chroma key mattes to be processed, as well as aiding in such chores as individual texturing and colour correction.

Graphic Paintbox

Graphic Paintbox also appeared in 1992. The company's previous products had offered picture manipulation, standards conversion and picture storage — next was digital picture creation.

While computer-originated graphics had been around for years, they all bore the ugly traits of the technology of the time: solid colours, jaggy edges and slow processing. A machine was needed to fill the needs of the artist, not the reverse.

The Paintbox's design approach boldly set out to answer this requirement. The use of a pressure-sensitive pen and graphics tablet satisfied the illustrators, but the *designers* were ill at ease with Paintbox's approach.

The realisation hit: designers organise existing elements into coherent design, adding linework and 'effects' where necessary. Enter the *electronic stencil*, applied using the same pressure-sensitive pen. Now, separate elements could be lifted from their backgrounds and re-assembled to form a totally new design.

The price (around £75,000) was against it, so a market had to be created. A few brave souls took it on board, so that now we see Paintbox systems almost universal in magazine production and TV graphics.

Paintbox development took into account the resolution demands of the printed page — at 14,000 x 14,000 pixels — and a screen resolution of 2000 lines. In operation, data is accessed at video data rates (27MB/sec), calling for a very 'smart' address system, coupled to ultra-fast, parallel transfer disk drives.



This scene from Warner Brothers' movie Streetcar Named Desire needed repair. Adjacent, undamaged frames were placed in Domino's picture store and selectively brushed through the torn section.

Hal and Dylan

Hal — the Digital Compositor — appeared in 1993, notable as the first all digital self-contained post production suite. In it Quantel focused on all the necessary functions: editing, digital effects moves (zooms, twists, etc), keying (up to 99 layers) of scenes, image retouching and tracing, graphic and text creation, colour correction and audio processing.

Extensive use was made of VLSI and ASIC circuit design to minimise component count and increase reliability. Circuit boards are multi-layered, surface mounted. The internal 520MB hard drive provides storage of fonts, graphic elements and 2.5 minutes of AES/EBU digital audio. Like Henry, Hal benefits from Chatter Disk Management, allowing 75 seconds of true random access video storage.

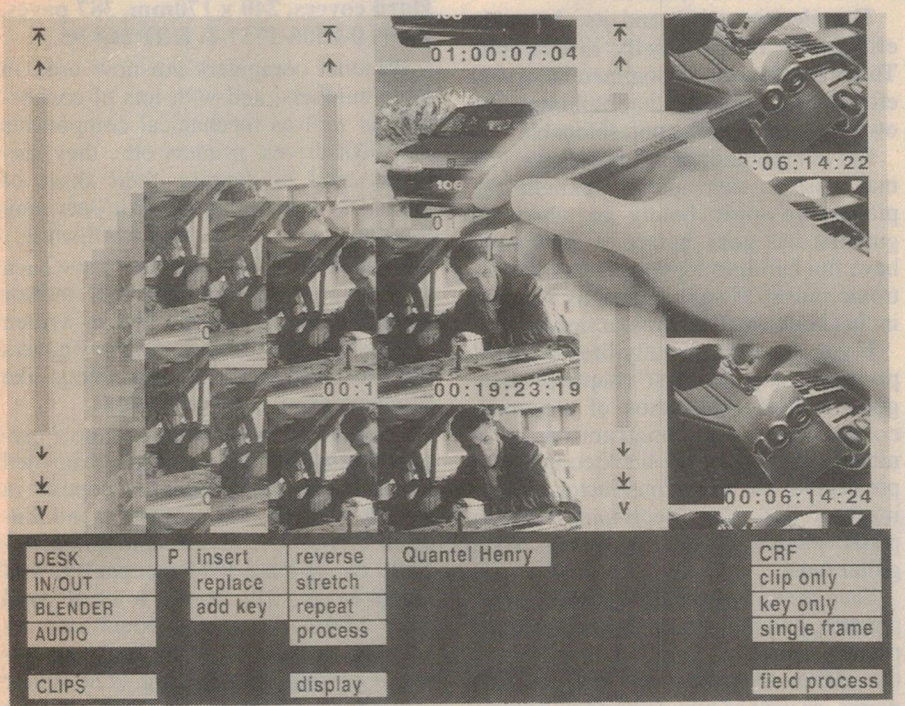
Dylan is an intelligent array of 20 high density 3.5" SCSI hard disk drives, supplying high capacity random access storage to a number of Quantel devices. Following Quantel policy the drives are standard, unmodified items stored in a unit 5U high, stored along-side their interface electronics. The drives are arranged in two layers of 10, each holding 7.5 minutes of video.

Domino, the film lab

First previewed in Sydney at SMPTE 1988, the Domino system displaces conventional optical printer and ancillary lab processes used in film production since the 1920s. Film in, film out, with editing in real time — and much digital processing in between. To achieve this Domino uses four basic components: a high resolution digital scanner, storage (Dylan), a workstation and a high quality film recorder to image the digital data back to photographic film.

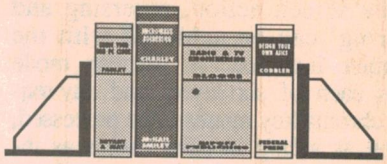
The scanner and output recorder are collectively known as the Domino Lab and offer input (35mm) resolutions of 2880 x 2048 or 1440 x 1024 pixels and 12-bit digitising. Scanning takes 30 seconds per frame, while recording back to film takes 60 seconds/frame. This module can also perform routine cosmetic work such as scratch removal and matte generation, for later layering of image over image. Frame by frame

Continued on page 51



The 'concurrent' editor, Henry appeared in 1992. For the first time, image multi-layering and random access, non-linear editing were combined in one 'box'.

NEW BOOKS



Radio history, plus

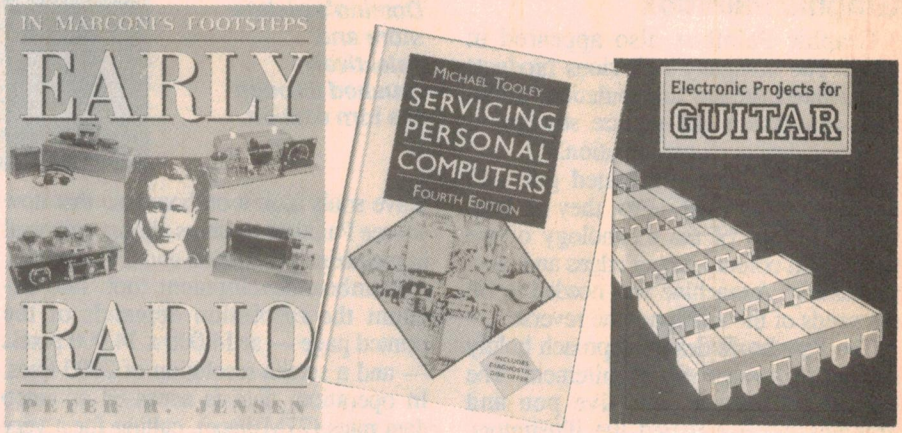
IN MARCONI'S FOOTSTEPS: EARLY RADIO, by Peter R. Jensen. Published by Kangaroo Press, 1994. Hard covers, 285 x 213mm, 176 pages. ISBN 0-86417-607-4. RRP $49.95.

Peter Jensen should be no stranger to regular readers of *EA*, as we've published quite a few of his articles in recent years. An architect and town planner by profession, he's also a keen radio amateur and a dedicated researcher of radio history. You'll no doubt recall some of his articles describing the construction of replicas of early radio equipment.

Marconi played a key role in developing radio as a practical medium of communications, of course, and although there have been a number of books written about him, in this new one Peter has taken a rather a different approach. The basic chronological account of Marconi's life and achievements is intertwined with a separate but linked narrative of Peter's own recent visits to key sites, such as the Villa Grifone near Bologna, Salisbury Downs, Dover, Poldhu and Clifden. Similarly although there are a large number of excellent historical pictures (some not previously published), these are also leavened by recent pictures taken by Peter himself. Many of the latter are in colour, too.

For the more technical reader, there's also a 'second half' of the book giving an expanded description of many items of Marconi's equipment and construction details for making replicas. And finally, at the rear there is not only a list of references but a set of seven data appendices, with things like selected letters written by Marconi to William Preece (later knighted), the British PO's reports of 1896 and 1897 on Marconi's experiments, facsimiles of Marconi's historic patents of 1896 and 1900 (the famous No. 7777), the 'secret report' by the Admiralty's Captain Jackson on the *Defiance* tests and Marconi's own report to his Company of 1901.

It all makes much more interesting reading than most other books dealing with this kind of subject, and should give even non-technical readers a good insight into Marconi's career and achievements. Peter Jensen and his publisher are to be congratulated on an excellent job.



The review copy came from the publisher, but I understand it will be available from many of the larger bookstores — and possibly also from our own Federal Marketing book service. (J.R.)

Guitar projects

ELECTRONIC PROJECTS FOR GUITAR, by R.A. Penfold. Published by PC Publishing, 1992. Soft cover, 190 x 245mm, 110 pages. ISBN 1-870775-31-7. RRP $24.95.

The electric guitar and its electronic effects are now virtually inseparable. There are plenty of commercial sound effect units; so many that building your own has now become unfashionable.

But as the author of this book says, you may wish to save money, rekindle the pioneering spirit, boldly go where no guitarist has gone before — or simply have fun building some gadgets for electronic music. If so, the designs featured in this book should suit your needs.

If you are electronically literate you'll probably skip the first chapter, which gives a brief explanation of electronic components and construction techniques. The rest of the book contains 16 projects for the home constructor, including a soft distortion effects unit, waa-waa pedal, phaser, DI box, auto-waa and a guitar tuner.

Each project uses garden variety components, and the author shows how each project is built on strip board. Naturally the author describes how each project works, as well as how to build it. There's also an extensive glossary.

The book gives many practical hints and the writing style is friendly yet economical. The review copy came from Astam Books, 162-168 Parramatta Road, Stanmore 2048, phone (02) 550 3855. The book can be ordered through most bookshops. (P.P.)

Computer servicing

SERVICING PERSONAL COMPUTERS, by Michael Tooley. Fourth edition, 1994. Published by Newnes/Butterworth-Heinemann. Hard covers, 240 x 170mm, 387 pages. ISBN 0-7506-1757-8. RRP $68.95.

Personal computers are now used in large numbers, and with lots of connectors as well as mechanical components like disk drives, printers etc., they certainly tend to develop their share of faults. So developing skills in servicing this equipment can be very worthwhile.

Earlier editions of this book have been very popular, motivating UK author Mike Tooley to produce this re-written and updated fourth edition. It now covers the latest 32-bit micros, and things like servicing serial communications.

For the Australian reader there's perhaps still a little too much space devoted to machines that were more popular in the UK than here (like Amstrad and Sinclair models), and not enough nitty-gritty on standard IBM compatibles and Apple Macs. Still, there's a lot of good basic information, and it would make an excellent starting place for anyone wanting to get into PC servicing. (The author offers a disk of diagnostic software, too.)

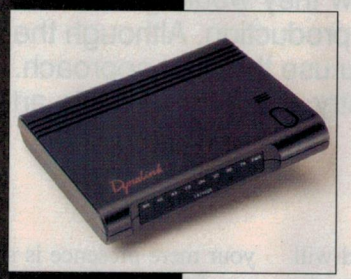
The review copy came from Butterworth-Heinemann Australia, of PO Box 5577, West Chatswood 2057. (J.R.) ❖

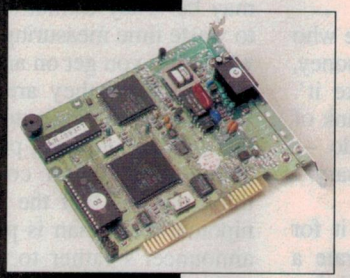
AUSTEL
AUSTRALIAN TELECOMMUNICATIONS AUTHORITY

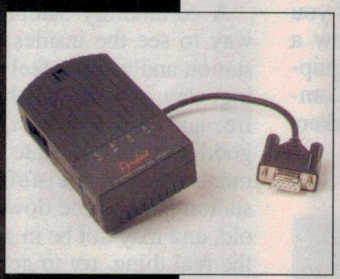
Only products that carry an AUSTEL Permit have been tested to meet AUSTEL's safety and technical standards.

approved affordable modems

1414VQC 1414VQM 1414VQH 1414VQE









Up to now when you wanted to buy a modem there were two choices. You could buy a "KamaKuza Special" with no Austel approval (you don't know if it's safe or will work properly) and a "factory warranty" (that means that if the dealer is still in business he will tell you where to send the modem overseas for repair, if the manufacturer is still in business) and whatever support the dealer can manage.

The other option was to pay a premium for a brand-name with Austel approval. Generally a more reliable product - you know it will work - a warranty you can rely on - some guarantee of support. The price premium could be substantial.

Askey Australia have changed that. Now you can buy an Austel-approved high-speed modem for about the same price as a no-brand. There's an unconditional three-year warranty - if your Dynalink modem fails you can return it to your dealer for replacement with no argument. There's a toll-free number for free support. If you and your dealer can't make your Dynalink modem work then we make it our problem at our cost, no matter where you are in Australia.

Dynalink MODEMS

A three-year warranty is only as good as the firm that backs it - our parent company (Askey Computer) is one of the top ten modem manufacturers worldwide and intends to have a permanent Australian presence. Askey make about 75,000 V.32bis modems per month for worldwide sale. Their product quality and performance are second to none. Askey has full ISO 9002 accreditation and the equivalent of Austel approval in about 20 countries.

The 1414VQE desktop and 1414VQH IBM card modems have been a runaway success since their introduction in August. The 1414VQM mini and 1414VQC PCMCIA models will be available from mid-September, all Austel-approved - at no-brand prices. Our software bundle has also had an enthusiastic reception. Dynalink modems are sold with both DOS (BitFax/Bitcom) and Windows (BitFax Professional) products.

ASKEY

Call toll-free 1800-653-962 (1800-OK-DYNA) for the name of a dealer near you.

READER INFO NO. 11

Practical career advice for young people:

SO YOU WANT TO GET A JOB IN RADIO OR TV?

Many young people with an interest in electronics wonder how they would go about finding a job in radio or TV broadcasting — either on the technical side, or in production. Although the broadcasting industry isn't the easiest to get into, this can be achieved if you use the right approach. Based on his own experience working in the engineering side of the industry, the author of this article is able to offer some very practical suggestions...

by BRYCE TEMPLETON

Have you ever driven your mother mad by dismantling her iron, or turning the vacuum cleaner into a clothes drier? Then you sound like the kind of person who would love to work in radio or TV broadcasting. It's the McGyvers of this world that are required here.

But how do you get into a broadcasting station? How do you know if you would prefer radio or the so-called 'more glamorous' television? There are plenty of places that will train you to be a radio or TV production person, but what about the backbone of the industry — the technician?

The answer is that you must do a lot of the work yourself. You must organise your own work experience, and you must annoy, nag or cajole someone to take you on as a trainee. All the technical college certificates or diplomas in the world will cut little ice, if you do not have the practical experience to back them up.

As in any job, there are the people who are in it because they need the money, those that 'thought they might like it'. Then there are those who cannot think of any other job they would rather do — they would do it for free, if necessary. I hope *you* fall into the last category.

In fact many people *are* doing it for free. They volunteer to help operate a Community Radio station (or TV, but there are not so many TV stations). If you do this, you can get an idea of how a radio station works, what sort of equipment is required (not much, in Community Radio!) and how other workers react to technicians.

For instance, announcers consider that your mere presence is sufficient to repair any fault, no matter how complicated it may be. They cannot see why you need to waste time measuring and checking — why don't you get on and fix it?

Quite often they are correct; all that you need is a finger to push the button that *they* should have pushed before they called you. But of course that sort of thing ensures that the myth of the omnipotent technician is passed down from announcer's father to announcer's son, and is only to be encouraged...

A community station may be a good way to see the insides of a radio or TV station and to get a feel for the broadcasting way of life, which is usually fairly free and easy. However, it is *not* usually a good way to see state of the art equipment. Most of the stuff in a community station is hand-me-downs; often it's very old, and may not be in good repair. To see the real thing, try to get work experience in a broadcasting station.



Master Control Room operator Larry Pye instructs Georgina Topp in ATN 7 Sydney's Network Control Centre.

Work experience

Rule number one is DON'T GIVE UP! Some places are good about work experience, but others will not consider it. You will get all sorts of excuses, such as "Our insurance will not allow us to take a work experience person". This is rubbish, and Workcover can supply insurance information.

Another excuse is "We don't have any qualified trainers". Which is again nonsense — you are not there to be trained, you are there to see if you like the insides of their station. Contact your local TAFE college, and of course, see your principal and get him or her to pen you a letter to the organisation of your choice.

It is also best to tackle the problem from both sides, as well. This is because if you only contact the personnel office of

a large organisation, they may not pass your request on to the chief engineer. On the other hand if you just contact him, he is virtually guaranteed not to tell the personnel office, as Chief Engineers have been known to forget about non-engineering things.

Pester them, try and see them in person if possible. After all a picture is worth a thousand words. If you are technically inclined, be sure and arrange the work experience in the engineering department and not a production area. Even so, you should have a look at the production departments while you are there — you may like that side of the industry better.

It is possible to do work experience even in the country, as it is rarely far to a radio station. Go and see the local station manager.

Which should you choose, radio or TV? Try both, if you can. Radio is a smaller industry, and so has fewer staff vacancies, but it is far more intimate and friendly than a giant network TV station with hundreds of employees.

A foot in the door

So you have done all of the above and decided that a techo's life is for you — what do you do now?

By far the best way is a traineeship with one of the big city broadcasters. Second best, but not by much, is a traineeship with country radio or country TV. Then there are jobs in domestic repair and with manufacturers and distributors. Let's have a look at them one by one.

City TV: This is definitely the way to get the most comprehensive training. These places have everything. With such a diverse range of equipment and trades and skills, if you can't find something to interest you here, maybe you should be on the buses or something.

You can choose from audio, video or computer based equipment (video character generators and special effect units). Then there is electrical, RF (microwave links, radio microphones, two-way radios and VHF or UHF transmitters), video tape, cameras, lenses, domestic VCRs and receivers, or other more diverse skills such as motor mechanics, air conditioning, even building trades — the list goes on!

City Radio: Pretty good, but of course you can't get much training on video stuff. However they *can* show you almost everything else.

Radio stations everywhere have been through lean times lately, and the engineering departments and equipment show it. Some large city stations are down to only one technician. This can be both good and bad. On the good side, it will expose you to a wider range of skills; the bad is that they may not want to take on a trainee. This is a very poor attitude and one that the broadcasting industry in general will live to regret.



Kate Johnston (left) and Karen Mayfield (right) work on a Soundworkshop audio console in ATN 7's audio post production suite.

Country radio: Now we are talking variety! Here you can fix everything from air conditioners to transmitters, from electric fences to microwave links and microwave ovens. They can't pay much, and the hours can be long, but for sheer enjoyment of work they cannot be beaten. None of the office politics that are rife in the city, no fixed ideas or hours, just 'make it go'. And the air is clean, too.

Country TV: This is unfortunately becoming an endangered species, as the change we had to have — 'aggregation' — tightens its grip and more small local stations get swallowed up by the networks. But there are *some* that have thrived under it. See county radio above, but more serious.

Going to tech...

Whatever you choose or can get, going to a technical college or university is a must. In the city, you are usually given some time off to go. In the country you may have to enquire at the closest TAFE college to find the best way to do a suitable course.

It cannot be stressed too much the importance of obtaining as many academic qualifications as you can while you are young, and unfettered by spouses, children and mortgages. In the future, no matter how good you are technically, the ability to get a good job will depend on your certificates or diplomas.

Take no notice of technicians who say all this 'book learning' will do you no good in the end, and practical experience is all that counts. It's true that at least one TV network's city chiefs have no diplomas. But the strict guidelines that employment agencies require, especially when headhunting, will mean that you will find it hard to change jobs in the future without the paperwork.

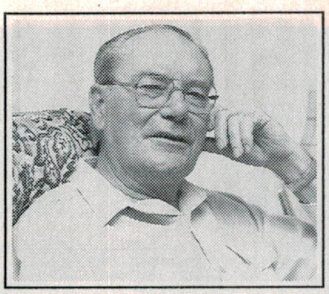
What if you can't get into a broadcasting station? Well, there are many production houses to try. They have a reputation of being even more casual than the TV stations. Jeans and tee-shirts are definitely the go here. The hours can be long, and the pace is quite often frantic, but afterwards you can probably have the next couple of days on the beach.

There is also the possibility of teaming up with someone who is doing freelance technical work, a growing industry. He or she will probably be a top-notch techo, as this is a very demanding lifestyle.

Distributors and manufacturers offer an option that is different, and can be very rewarding. It is, however, sometimes difficult to change from this line of work to a broadcasting station, as your experience may be limited to one brand or type of equipment.

Then there is the domestic repair industry, a very good way to get your training. Maybe you can change to broadcasting later, if you can take the drop in pay!

In closing, don't expect to see your name in the credits. Even if you have just worked night and day for two weeks to get a show to air, directors and producers think that technicians should not be seen and not heard. ❖



When I Think Back...

by Neville Williams

Harry Mauger - 2: Photographer, radio technician, amateur, soldier and recording engineer

In the first of these articles, we looked at the early part of Harry Mauger's career. Here we take up the story in 1956, at the start of the microgroove LP era. Harry was now the Technical Manager of Astor/Mercury Records, and he found himself responsible for setting up the company's new record plant at Huntingdale.

At this point, it is appropriate to remark that, in collating last month's instalment, I learned a great deal more about Harry Mauger — pronounced 'Major' — than ever I had gathered from my hurried business trips to Melbourne. On such occasions, by the time we had discussed matters of immediate mutual interest, it was time to head off to the next appointment! There was little opportunity for getting-to-know-you reminiscing.

Such being the case, I must confess that I didn't fully appreciate Harry Mauger's dedication to the job in hand, or that of the Astor/Mercury team that worked with him. In Sydney, by contrast, we were actively aware of personalities in the local Columbia/HMV/EMI group, with their worldwide affiliations, their established facilities at Homebush and their new high-tech music studios in Castlereagh St, City.

With hindsight, it would now appear that the Astor/Mercury team was no less committed to the production of technically commendable recordings — although, for the most part, with little in the way of overseas support.

The team had demonstrated its ability to make records — and money — in a supposedly 'tin shed' at Richmond but, as the focus shifted from 78rpm discs to microgroove, the need became evident for improved facilities and conditions. I n 1956, management agreed to establish a new plant, especially designed for record production. This was at Huntingdale, across the road from the Anodeon valve factory, in which Astor held an interest. By then, Charles Gendle had retired and Harry Mauger had become Technical Manager.

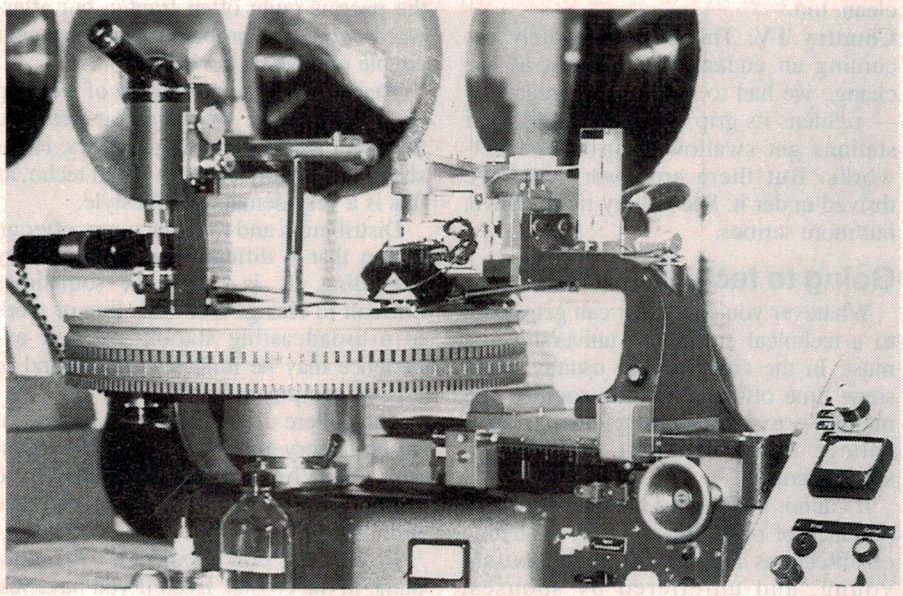


Fig.1: The Neumann Recording Lathe, still in use in the Clayton factory when it closed down — a ZT32S, modified to incorporate a SX74 helium-cooled recording head and a solid state drive system. Note the groove inspection microscope at the top left, poised above the turntable.

Harry says that production of records on the anticipated scale required lots of steam and also lots of cold water. Fortunately, the new factory could buy steam from the Anodeon factory, which had installed a large boiler to heat water for washing TV tube glass. To gain access, however, Astor/Mercury had to run a supply pipe operating at 100 pounds per square inch, under a public road.

They were not allowed to dump warm water, heated after cooling the dies, nor could it be redirected into the copper pipes of the boiler. As a result, a 16-ton refrigeration plant and cooling towers had also to be installed, to cool it for re-use in the presses. As Technical Manager, it was a sore point with Harry that they were paying good money for electricity to heat water and cool water at the same time!

There were 12 presses in all, each capable of producing around 1000 disc records per day. They were positioned in the factory to obviate the need for right-angle bends in the supply pipes, and thus minimise 'ventura' effects. (For those of us who are unaware of such matters, Harry observes that "steam at high velocity is almost as fussy as RF in transmission lines...")

As they came off the presses, all discs were visually inspected before packing and at least one in every hundred was auditioned in a sound- proof room — a luxury after the all-pervading traffic and production noise at the original Richmond premises.

World-class equipment

In due course, with hifi stereo having taken over, the time had come to pension off the original Connoisseur lathe. This was replaced with the latest Neumann recording lathe and cutting system — the first of its kind to be imported into Australia. It was purchased complete with amplifying equipment — still valve based in those days — and a Studer C37 tape system. All of this was regarded at the time as the 'Rolls Royce' equipment of the record world.

Says Harry Mauger (my precis): "A story must be told about this first Neumann. As supplied, it came with a handbook and instructions in German. But although we had two German employees, they could not cope with the technical terminology. We managed to extract a 'short list' in broken English on how to set up the cutter, which turned out to be a complicated procedure requiring the negative feedback to the cutter to be adjusted methodically to avoid burning out the windings."

"It involved advancing the level slowly, until the meter on the panel read 100mA. The trouble was that the aforesaid meter was calibrated in 10 steps between '0' and '1' with no other markings. We took a punt and brought it up carefully to full scale. What we didn't discover until later was that the meter was set up to read 0-1 amp!"

"I had the job of going cap-in-hand to the General Manager, to confess that we had burned out the new $5000 head without ever having recorded a note. The repair cost us $1500, a couple of months delay and some very red faces!"

"Fortunately, once we had become familiar with the equipment, Bob Morrison did wonders with it and for our Company reputation."

Astor finished up cutting virtually all of their own Masters locally, thereby minimising reliance on imported counterparts — which they found to have more than their fair share of clicks, plops and overcuts. At this stage, the company was pressing over 20 labels, including Vanguard, Mercury, Electra, Pye, Audio Fidelity and Hi Fi, plus local productions on the Astor label produced in the studios of Channel 9 TV. There were also lots of limited-run custom pressings.

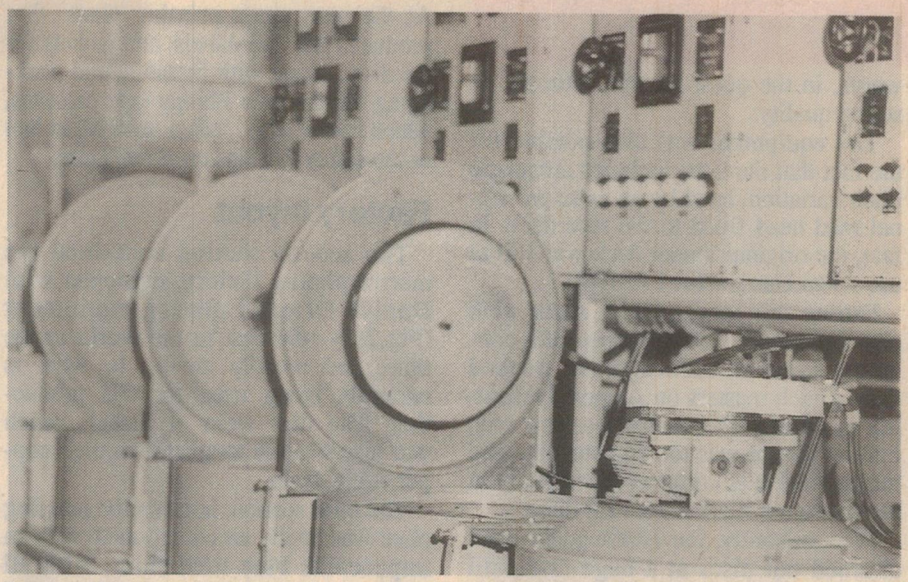


Fig.2: The line of Ortofon Plating Equipment. When the picture was taken, only the tank on the extreme right was actually working.

As an aside, Harry mentioned that the production arrangement with Channel 9 exposed an element of friction between Mercury staff and the Station's own operators, who were formally licensed Broadcast Station operators. To forestall the demarcation, Harry sat and qualified for the relevant professional 'ticket'. Having done so, he also sat for and passed the requisite Morse code test to gain his amateur licence — a useful bonus for retirement!

He was duly issued with the callsign VK3KAE but what little time he could devote to amateur activities at that stage tended to be absorbed in fiddling with equipment and DX listening, rather than actual transmission. Along the way, he also became a member of the IRE (Institution of Radio Engineers, Aust) — now the IREE (Aust.).

State of the art

Getting back to his occupation, the Neumann/Studer mastering system could be set up to cut discs at half speed, to minimise possible transfer difficulties at the higher frequencies. Special Pultec equalisers had to be used to compensate for the 2:1 downward shift in the apparent frequency range. Despite the extra setting-up and the longer transfer time, half-speed mastering was frequently specified by clients from 1960 on-

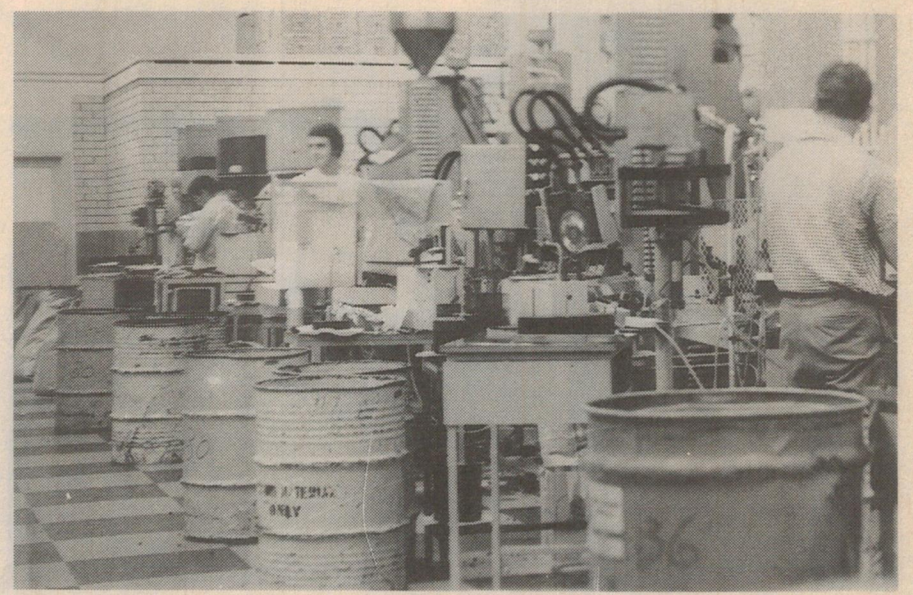


Fig.3: Three units of the press line at the Clayton factory. Harry Mauger's deep regret is that equipment like this, and the local operator know-how have been relegated to history!

wards, in the quest for the 'ultimate' in sound quality.

The equipment was also notable for the fact that the lathe included automatic pitch variation, cued by an extra pre-signal read head fitted to the tape deck. In fact, the original Studer deck was still in use when Harry retired in 1980.

During this same period, Astor were also producing 7-1/2ips open reel consumer tapes at Huntingdale, dubbed from 1-inch masters on Ampex duplicating machines. The quality was first rate, but the format was too cumbersome and too expensive to compete successfully in the consumer market with LP discs.

Predominantly, the Huntingdale plant churned out discs at a huge rate until 1968. The one activity missing from the complex was plastic milling, occasioned by the fact that there were two alternative suppliers. As well, technology was changing to the use of extruded granulated plastic; this involved the substitution of new imported presses for the faithful old Johns equipment.

By about 1968, following a buy-out by Philips, most of the original Astor Company activities had been transferred to the Philips Clayton site and it was duly decided that the Huntingdale record facility would also be re-sited. Management decided that the job was to be done 'properly', resulting in what was probably the most modern factory of its kind in Australia.

Harry says that the new Clayton factory was divided into four main sections. At the rear was a printing plant that produced all the labels and jackets for the discs, along with literature and packaging for the new Philips tape cassettes, which were also 'taken aboard', in lieu of the earlier 7-1/2ips open-reel tapes.

Factory layout

The second section contained the matrix plating facility, equipped with Danish Ortofon plating equipment (Fig.2) — the best in the world at the time, and broadly similar to what is currently being used for CD production. The dies were of nickel, which was significantly tougher than their copper equivalents.

The third section, housing the pressing plant was totally air conditioned, with an impeccable blue tiled floor, with all water and steam pipes run underground (Fig.3). The plant itself comprised a dozen Swedish Alpha presses, fully automated and fed with Alpha extruders that fed the correctly heated and weighed plastic.

The plant and installation was equal to the best in Europe, as also were the working conditions for the staff — and for the products. Harry adds that Alpha still make most of the pressing equipment used for compact discs. Section four, also air conditioned and dust sealed, was set aside for the production of tape cassettes. It was equipped with Ampex high-speed duplicators and automatic loading and labelling machines. More about that in a moment. In all, the Clayton factory contained three sound-isolated rooms, one of which was used for Master cutting. It was equipped with current Neumann recording equipment, complete with amplifiers, groove and depth control system, equalisers and audio control desk.

Cutter heads were replaced every few years, thereby keeping up with both wear and tear and evolving technology. The cutters were helium cooled to permit high recording levels without heat overload in the windings.

Another of the sound isolated rooms produced the 1-inch masters for cassette production, using Studer and Ampex machines. It involved dubbing two stereo tracks, side by side, one in the reverse direction, as per the cassette format. To mark the start and finish of the overall cassette program, the masters were cued with six cycles of a particular audio tone.

Cassette production

For the actual cassette duplication process, the 1-inch cassette master or source tape was loaded into a 'bin' with start and finish joined, to form an endless loop which could thereafter be cycled continuously through the replay deck, carrying the program plus the 'start-finish' cue tone.

From this source tape, the contents were dubbed on to cassette format tape stored on 12-inch (30cm) reels which therefore finished up with a large number of complete cassette programs, bulk-recorded end to end but separated by start/finish cues. These reels were then placed on an automatic tape loading machine with a hopper full of 'C-zero' cartridges — normal cassette cartridges with only a short blank leader/trailer tape joining to the two spool hubs.

The equipment would monitor the tape coming off the 30cm storage spool and, prompted by the cue, would slice the leader at mid point, slice the bulk-recorded tape and automatically splice the two, thereafter diverting the recorded tape into the cassette. At the next cue, the procedure would be repeated to slice the feed tape, splice the end to the leader/ trailer, take up the slack and drop the now functional cassette into a bin ready for packaging.

Harry says that they used German tape for the cassettes — presumably BASF. The C-zero cartridges themselves were variously made at Clayton, imported from overseas, or assembled elswhere in Australia. In fact, he says, the plant became something of a showpiece and, with Frank Hulbert and the Neumann producing the Masters, and pressings by courtesy of Ortofon and Alpha, they ended up cutting and pressing most of

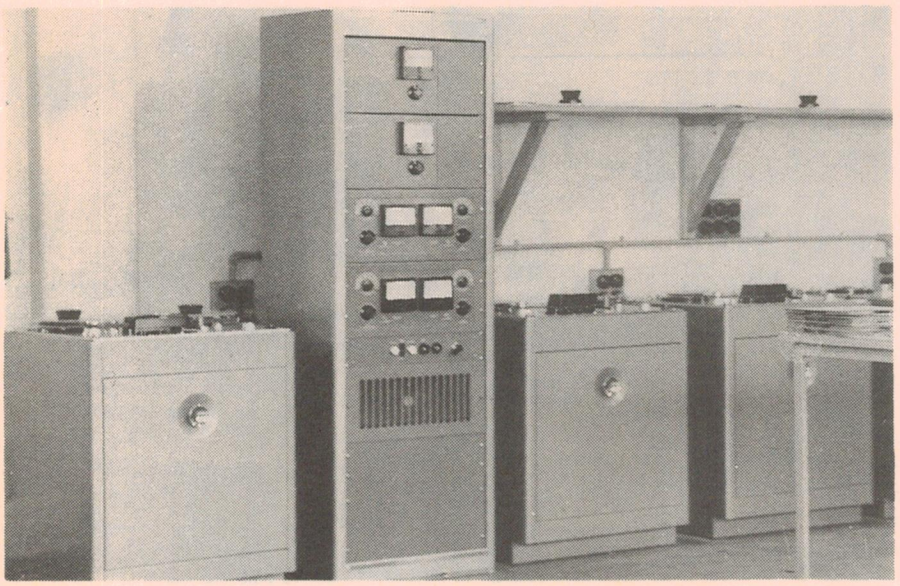


Fig.4: Some of the tape duplicating equipment at Clayton. Once set up, the tape cassette production proceeded automatically, requiring only occasional operator intervention.

THE STORY BEHIND AUSTRALIA'S FIRST DIRECT-TO-DISC STEREO LP.

In the 78rpm era, performances had, originally, to be recorded direct to a master disc. Unacceptable faults could only be eliminated by repeating the exercise — which, fortunately, wasn't too much of a problem with sides lasting a mere three to four minutes.

The introduction of tape masters reduced the pressure on engineers and performers alike and, in practice, the flexibility of tape mastering made LP discs practical on a large scale.

In the 1970's, however, dedicated hifi purists began to question the presence of a tape link in the recording chain, along with the use of complex microphone and mixing techniques. In response, specialist recording companies set about making promotional D/D (Direct-to-Disc) recordings for sale to hifi devotees.

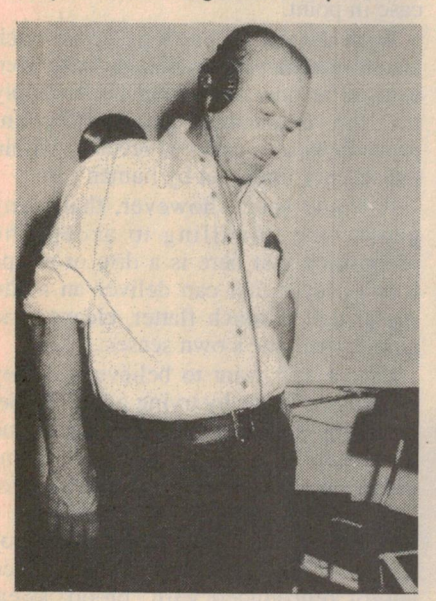
Astor/Mercury released just such a disc, as featured in our August 1978 issue, in collaboration with Jazznote and the then World Record Club. Behind the initiative was jazz old-timer Harry Mauger, recording engineer Frank Hulbert, President Max Hawton of the Audio Society (Melbourne) and veteran Audio Engineer Max Hull.

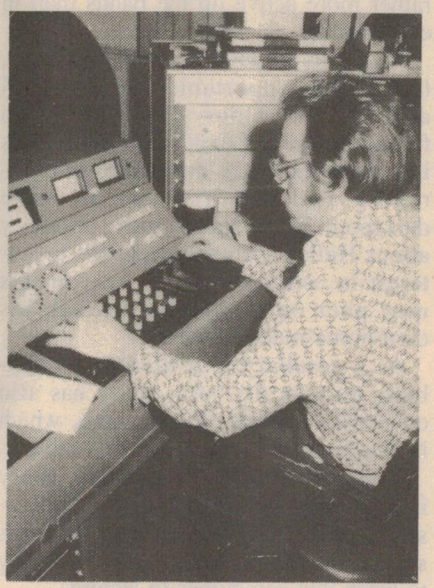
To do so, they had to adapt one of their soundproof rooms for use as a studio, linked by audio lines direct to the cutter control desk. They also had to locate a small professional group prepared to commit themselves to two 15-plus-minute segments, without 'fluffs' and with only brief pauses between the items.

Agreement was duly reached with the Steve Murphy Quartet, with Steve Murphy on Hammond organ, Jack Gay on electric guitar, George Aylor on drums, and Maurie Sheldon on electric bass. To minimise the intrusion of instrumental loudspeakers, splits were available from the source amplifiers.

The result was 30-plus-minutes of what Harry Mauger described as 'free-wheeling jazz', offering very good sound quality. Whether it was subjectively better than what would have been available using a tape link, he was not prepared to say. In effect:

"As you would expect, the sound is very good. But it could only be rated better than a tape mastered version if it is shown to be free from discernable artefacts that would characterise the latter. One's reaction otherwise is based primarily on one's rapport with the program contents"!





At left, Harry Mauger, Astor Pressing Plant Manager, listens to the audio mix of the disc "The Steve Murphy Quartet Direct". At right, Frank Hulbert, Cutting Engineer at the Melbourne Astor Plant keeps a watchful eye on the stereo balance being fed to the SX74 cutting head.

the records by local artists, as well as highly commended work for prominent overseas labels.

On one occasion, he recalls, they had a lunch appointment with a very famous overseas artist and his manager. At 10am on the day, the manager handed them a Master tape. At 2pm, after lunch, they handed him back a pressing! He was amazed and was heading back to Britain 'to have a few words' aimed at getting their own production people off their butts!

End of an era

In 1975, Harry Mauger had a slight stroke which, if nothing else, warned him of the passing years. He retired in 1980 but, as it happened, he didn't miss much in terms of the analog era.

Just as microgroove records had swept aside the solidly entrenched 78's around 1960, 20 years later they suffered the same fate from the digitally based compact disc. From being a showpiece for the Philips group, the Clayton factory was shut down in 1981 — leaving Harry Mauger, the old-timer from the days of Eclipse and Astor, with an interesting assortment of quotable memories.

"Towards the end of the era", he says, "there was a resurgence of enthusiasm for running Master tapes at 30ips, or even eliminating tape altogether and recording direct to disc.

Back in the old days, recording engineers had *no option* but to record direct to disc, even for 15-minute broadcast transcription work. When tape did arrive on the scene, European engineers in particular initially favoured 30ips because the slower speed technology at the time was barely equal to the task."

"Cyril Stevens of Spotlight Variety Records (Melbourne) always used 30ips Masters, but he preferred to record performances in his own studios direct to disc. He used to say 'They sound better'!"

"I still have one of his records of the Ballarat Choir, which I believe was the first all-Australian stereo record, mastered by Cyril at 30ips and cut and pressed by us. I played it recently and it still sounds great!"

"Early in the LP era, we were using copper dies (stampers) which had a bad habit of stretching (becoming 'off-centre') and of splitting along the run-in groove. We switched to nickel and sulphamate nickel, immediately after its introduction in Europe."

"We also developed a method of lowering the cutter inside the groove guard bulge, to further minimise splitting. Eventually, Neumann took up the idea and incorporated provision for it in their lathe."

On-the-nose plastic

"There was considerable controversy over plastic — the local product versus imported alternatives. Personally, I only ever found one overseas plastic that gave better moulding and better sound than the local product. But — the staff refused to use it because it gave off a horrible smell when heated! It was technically excellent but of no stinking good!"

"In everyday practice, I found that a deliberate mix of good re-used plastic with virgin plastic in proper proportions moulded better than the virgin plastic by itself, having superior flow characteristics. But, virgin or mixed, most of

the problems experienced with plastic were attributable in the ultimate to overheating or burning."

"When cutting masters in stereo, any out-of-phase causes the cutter to rise out of the groove, such that the cut can become sufficiently 'thin' to aggravate groove skipping. The Neumann lathe had both automatic depth and pitch control to counter this problem."

"In practice, incidentally, towards the inner grooves of an LP disc, the track tends to revert to mono below about 100Hz. No matter — it's hard to set up independent 50Hz wavefronts in a living room. "Most clicks and plops occurred in the plating process. We played our Mother Matrix — they can be played with a normal top quality pickup — for purposes of quality control. As part of the equipment, we had a stereo microscope for groove inspection and the means to physically engrave clicks out of Mothers. This, in fact, was standard practice in most record factories." (Acoustic microsurgery?)

"Due to the rising frequency compensation adopted for LP disc recording, a lot of power was necessary to drive the cutter to the requisite velocities at the top end of the spectrum, especially when recording repetitive highs, as for a rhythm cymbal. Overheating and burnout of the cutter windings was a daunting and expensive occurrence."

"Quite early in the history of LP recording, the idea was adopted of pumping helium through the cutter winding assembly to combat heating, while signal limiters were also devised to automatically keep the signal drive within the AES curve. Even so, 'virtuoso' panel operators in the studios often had to be reminded not to overemphasise the high frequencies."

Retired, but busy

Okay, so what *does* a retired recording engineer do in his spare time? Well, Harry is still a member of the IREE and he's still an active amateur — indeed, rather more active on the bands than in earlier years.

He's still interested in photography, too, and as opportunity permits, still adds to his colour slide collection featuring native fauna. In addition he's interested in black-and-white photography and has his own private darkroom. For extra measure, publicity about Halley's comet triggered an interest in astronomy, and his cameras now peer on occasions through his own home-made telescope!

As a corollary to a lifetime of rambling through the bush, Harry has also collected his share of gemstones, which he has learned to cut, polish and mount.

And, as for mental stimulation, Harry is associated with Melbourne's University of the Third Age, where he joins several hundred other people — mostly to listen, but sometimes to lecture.

Last but not least, I put a question to him as a man who had spent much of his adult life listening critically to original musical performances and recordings thereof: What was his reaction to the talk about the relative 'musicality' of analog and digital recordings?

Without hesitation, he professed to having little sympathy for the proposition, attributing it mostly to 'sound they have grown used to' and an emotional attachment to particular performances associated with particular equipment.

Out of the discussion came the point that, throughout the analog era, a certain degree of satisfaction — technical 'fun' — has been derived from being able to seek and win marginal improvement by personal attention to detail and/or saving up for a more expensive this and that. Phono decks, cartridges and stylii were a case in point.

With digital technology, most such electro-mechanical limitations have been excised at one stroke and there simply isn't the comparable scope to effect improvements at a personal level — within the sensory limits set by human ears.

It would seem, however, that many people are unwilling to accept the proposition that here is a disc or a tape and a player that can deliver an audio signal that is much flatter, cleaner and quieter than one's own senses.

People still want to believe that they can go one better by trying a little harder or buying a more expensive model. And what supplier is going to dissuade them? Harry says that he has a high regard for CD records and has collected quite a few, but he can still listen to and enjoy LP records that have been produced and/or reproduced with 'blood, sweat and tears'!

"In fact", he concludes, "When I look back over the complex mechanical and electrical problems that have to be tackled in recording music by any format, I cannot but marvel at how close we've been able to get to the original."

Having just listened again to the Astor/Jazznote direct cut, I won't argue with that! ❖

ACN 009 892 031

WHOLESALE RETAIL

PINBALL MACHINE DISPLAYS



CHERRY

- SCORE/ALPHA NUMERIC DISPLAYS
- KEYBOARDS - GRAPHICS DISPLAYS
- ELECTRONIC COMPONENTS
- MICRO SWITCHES

DelSound

1 Wickham Terrace
Cnr Ann & Wharf Streets
Brisbane Qld 4000
Phone (07) 839 6155
Fax (07) 832 5278

- ICOM COMMUNICATIONS
- HEWLETT PACKARD CALCULATORS
- SWANN SWITCHES
- ARISTA

OVERNIGHT DEL AVAIL

FAX ORDER PHONE ORDER

CUSTOMER PARKING AT REAR

READER INFO NO. 6

NIGHT VISION

Well kept Military secret for years. Full range of Russian Military Hi Tec. Electro-Optical Equipment

TZS-2 1st GEN

SPECIFICATIONS :

MAG	2,3x
Light AM	1500 x
Weight	0.9kg
Power Supply	2AA Batteries



$290

Optional Laser illuminator $190

B-7 2nd GEN + Automatic Brightness Control



$1850

SPECIFICATIONS:

Light AM	40.000x
Range	900
MAG	2.4x
Power	9v batteries
Weight	1.5kg

DISTRIBUTORS

NSW BIS Australia PTY LTD (02) 553-9507 Show Room Open 1st flr 196-198 Railway Pde Kogarah NSW 2217

VIC BRITE STAR (03) 889-5590

QLD NIGHT VISION SYSTEMS (07) 870-9643; Mobile 015 124 746

IMPORTERS WELCOME

RUSSIA PHONE & FAX + 7 812 218 4264

CONTACT PHONE IN AUSTRALIA + 612 553 9507

READER INFO NO. 7

ELECTRONIC TEST GEAR TO BUILD

Volume 2

Test instruments are important tools for anyone who needs to work with electronic circuits — whether you're a designer, a service technician or a hobbyist experimenter. With the right test instruments, you can tell quite accurately what is going on in a circuit, but without them, you're often forced to rely on luck and blind intuition.

This book is a collection of some of the most popular designs that we've produced in the last few years, brought together and re-presented by popular demand. In each case, you'll find that as well as the original articles, we've also included any subsequent notes and errata on the projects concerned, to make sure that you have all the information needed to make each project a success.

Copies can be obtained by sending $7.50 (post and handling), to:

The Book Shop,
Federal Publishing Company,
P.O. Box 199,
Alexandria, NSW 2015.

MELBOURNE SATELLITES

82 BAYFIELD RD, (P.O Box 901) BAYSWATER, VIC.,3153 Phone: (03) 738 0888 Fax: (03) 7298276

Talk to the company that supplies over 60 systems a week, Australia wide.

Here's what you get in a Ku System Kit:

- 1.5 metre Andrew, Australian made Antenna
- Full pole mount with Az/El adjustment
- Dual Polarity Low Noise Block Amplifier
- C120 Feedhorn Assembly and mounting hardware
- Echostar SR-720 Infra Red Remote Satellite Receiver
- 25 metres RG-6U Low Loss Coaxial Cable
- Pointing co-ordinates to suit your location

Complete Ku System for only $995*

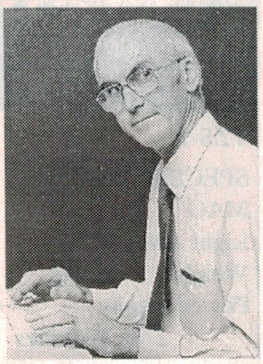
**plus delivery/insurance*

Phone, fax or write for details and a comprehensive price list.

READER INFO NO. 8

FORUM

Conducted by Jim Rowe



More on disposal of electronic scrap, and on soldering safety...

I have some very interesting items for you this month. One letter comes from a music retailer, and reports on strange compatibility problems between some CD's and players. There's also a response from the Australian company involved in that shipment of 'electronic scrap' which was refused entry to the Philippines earlier this year, and a rather worrying first-hand report on the subject of health risks from soldering. For good measure, another reader enquiring about radio interference generated by 'touch sensor' lamps, and computers which trip residual current detector safety switches.

Before we look at any of these items, though, I have a small correction and apology to make. In the October column, on page 42, I wrote that the full meaning of the acronym 'WARC' was 'world amateur radio convention' — which is wrong, of course, as the WIA's Bill Roper VK3BR gently reminded me soon after the issue was published. It stands for World Administrative Radio Conference, and I can't think why I made this silly mistake. My apologies, and my thanks to VK3BR for bringing it to my attention...

Now let's look at the first of our letters, which concerns a topic rather different from anything else we've discussed recently. It's about what seems to be a compatibility problem between some compact discs and CD players, and it comes from Mr Gerard Lawrence, who is in Batemans Bay in NSW and works in an electronics/music/photography retail business there.

I must confess that I've had Mr Lawrence's letter for a few months now; there hasn't been an opportunity to use it until this month. So belatedly, and with my apologies for the time he's had to wait, here's what Mr Lawrence has to say:

We frequently encounter a problem of incompatibility between a particular compact disc and a particular CD player.

Examples of this problem occur with our customers about once a week or so. It makes us wonder how often there must be occurrences with large city record stores.

What happens is this: a customer will return a CD saying it will not play some part of the recording, and advising that their player has no trouble with all their other CDs; we test it on our very basic store player and there is no fault. Now that we have experienced the problem so often, we simply give the customer a replacement disc. This frequently overcomes the problem. If it does not work on the customer's player after three tries, we suggest they give it up and swap for some other album.

It is not the same album that different customers will return. (Should that happen, it is inevitably a manufacturing fault and it will occur on our store player as well as every other player.)

There is no pattern that we can discern such as CD manufacturer, type of recording, type of CD player, etc.

These returned CDs are put back into stock. Subsequent purchasers have no problems with those CDs on their players.

It irks us that as retailers of CDs and electronic equipment we cannot explain to our customers why they alone have this problem only with this disc, and only on their player.

In the words of the late Professor Julius Sumner Miller, "Why is it so?"

Hmmm — what do you make of *that* one? I can't say I've heard of this kind of problem before, which perhaps suggests that it may not be as widespread a problem as Mr Lawrence seems to think. Of course there's always a chance that lots of other people have been having the same problem, and just haven't noticed the pattern (or lack of it).

Exactly what kind of a fault would cause this type of compatibility problem, however, I can't imagine at present. If a disc were significantly 'out of spec' with regard to any of the important parameters, I'd expect that it would give trouble on almost any player; not just the odd one or two.

Unfortunately dear old Professor Sumner Miller isn't around any more, to help us find an answer. But perhaps someone from the CD industry will be able to help instead, by clarifying what kind of fault could produce this type of 'selective compatibility'. It's certainly a bit puzzling, as Gerard Lawrence suggests...

Thanks for drawing our attention to it, Gerard, and I'm sorry it took a while to get to your letter.

Toxic computer scrap?

Moving on, you might recall that in the July column, I presented an item sent in by reader and occasional contributor Colin MacKinnon, of Glenhaven in NSW. It was an excerpt from a shipping newspaper, with a UPI report dated March 2, regarding the refusal by Manilla's Customs officers to allow a vessel called the *Gamzat Tsadasa* to unload containers of what were described as 'toxic industrial waste' originating in Australia. Elsewhere in the story the contents of the containers were described as 'computer scrap', and Greenpeace was quoted as saying that 'computer scrap is among the most lethal forms of industrial waste'.

The implication of the story was that we Australians were blithely and irresponsibly dumping our unwanted computer junk in a less fortunate country. Perhaps tongue in cheek, Colin MacKinnon wondered if the only responsible thing to do was bury his old computers in the backyard...

Disposal of toxic materials is a serious problem, of course, and I'm sure many Australians are concerned about it. Few of us would regard simply 'shipping it away to a less fortunate country' as an acceptable or responsible solution, and that's why the story attracted my attention. All the same, dumping scrap over-



seas didn't sound like an option that our industry or authorities would have condoned — suggesting that there might well have been 'more to it' than was mentioned in the story concerned.

As it happens, there *does* seem to be more it, as our next letter explains. And it's a very interesting and relevant letter, as you'll discover, because it comes straight from a Director of the very company which had exported the containers mentioned in the story. Mr Chris Jankos is the Director concerned, and his company is Hitechnology Metal Recyclers, based in Campbellfield, Victoria.

Here's what Mr Jankos has to say:

I read, with some interest, a piece in your Forum column (EA, July 1994) entitled 'Irresponsible Australia', referring to a shipment of computer scrap exported from Australia and delayed in unloading in Manila.

As a Director of Hitechnology Metal Recyclers, the company who exported this material, I believe I may be in a position to answer some important questions your column raised and hopefully allay Mr MacKinnon's fear of being unable to recycle his redundant computer/electronic equipment.

H.M.R. has been involved in the recycling of computer, telecommunications and electronic equipment Australia-wide for over ten years, and currently processes in excess of 15,000 tonne per annum.

The process for recycling this material is basically as follows:

Upon receival at our branches, the material is manually pulled down and separated into five categories and recycled as follows:

A. Ferrous metal (steel frames, panels, chassis, etc). This is passed on to steel/iron foundries and recyclers for resmelting.

B. Non-ferrous metal (aluminium, copper, stainless steel, brass, etc). Passed on to various base metal refiners/recyclers.

C. Circuitry (circuit boards, backframes, plugs, etc). Passed on to various Australian and international refineries specialising in the recovery of precious and base metals.

D. Plastic/glass (panels, casings, monitors, etc). The majority of this material can be granulated and recycled locally.

E. Low grade base metal scrap (power supplies, transformers, iron and aluminium, etc). This material is exported to our sister company C.R.A. (Philippines), and is made up of ferrous/non-ferrous computer components/parts which require a high labour content to process.

C.R.A.'s process is similar to that set out above, in that this material is disassembled manually down to the last bolt and separated for re-export to Australian and international refiners. At no stage are chemical or incendiary methods employed in C.R.A.'s processing.

Since March, when our containers were delayed in Manila, our facilities and process have been inspected by authorities from Australian and Philippines Government Departments, including C.E.P.A., Customs and D.E.N.R.

At no stage were there arrests, charges made or any shipments returned to Australia. In fact, our process was not found to be in violation of any Philippines, Australian or International Law. Today we continue our business with the approval of all relevant Government Authorities, in the knowledge that through our process passes 15,000 tonne p.a. of material recycled back into industry, instead of going to land fill.

As a modern consumer society, we are faced with a choice of:

A. Making use of technological advances and the modern convenience of life as we know it, and simply bury our refuse in the backyard for our descendants to worry about.

B. Renounce modern life and the trappings that go with it and return 5000

years to live by our animal instinct and natural resources alone; or
C. Make use of the technical and consumer conveniences that our ever-advancing scientific society provide to us, with an understanding that, along with this lifestyle goes a responsibility to conserve and recycle the world's resources.

Many companies, including most computer manufacturers have programmes whereas they aim to make their products completely recyclable. This is a very practical and amiable approach to the resource recycling dilemma. However, to succeed it needs us, the consumers, to decide that we WANT to recycle.

Well, there you are. There *was* more to it than met the eye, it seems, and I'm sure we're all grateful to Mr Jankos for taking the trouble to explain the situation.

It's reassuring that the scrap concerned was not being 'dumped' in the Philippines, nor sent there for environmentally-unfriendly incineration — merely being sent there for stripping down and recycling, at a lower labour cost. Fair enough; stripping down this kind of equipment must be very labour intensive, and it's understandable (even if unfortunate) that this means shipping it overseas to have the job done economically.

I think you'll agree that as well as clarifying the situation, Mr Jankos has also given us all food for thought, in those comments at the end of his letter. I guess the bottom line is that we hi-tech consumers *all* have to bear our share of the responsibility for disposing of our obsolete or faulty equipment in a responsible manner. We can't just throw it out in the council's cleanup, or the company's waste disposal skip, and then frown disapprovingly at what is then done by the people who DO have to work out what to do with it...

Soldering risks

Moving on again, I've had another very interesting and thought-provoking response to a recent item. This one is a letter from audio technician Trevor Wilson, of Hurstville in NSW, and it's adding another dimension to the discussion we've been having about possible safety risks associated with soldering. You might recall that A.J. Lowe of Bardon in Queensland first drew our attention to the potential risks of soldering fumes, in the March issue; then in June, a reader from South Australia using the pen name 'Jamo' provided more information on this, and also discussed the risks of eye damage from flying solder. Further information on the latter aspect was then provided by Garry Boyce, of Crafers in South Australia, in the October column.

Trevor Wilson's contribution returns us to the possible risks associated with the soldering *fumes*, and like Garry Boyce he writes from direct (and unfortunate) personal experience. However the focus of Trevor's concern is not so much the nasty resin-derived chemicals present in the soldering fumes, but the tiny particles of metallic lead that are almost certainly present as well. This raises the very worrying problem of lead toxicity, as he points out:

I read, with some interest, the discussion in the Forum pages about the problems associated with soldering. I would like to offer my personal experience relating to the dangers of soldering. (Apart from the usual burns!)

Several months ago, in response to some niggling, but not serious health problems, I subjected myself to a series of blood and other tests. These revealed a calcium deficiency. Through some interesting detective work by several specialists, the problem was eventually traced to a malfunctioning liver. This problem was caused by an excessive heavy metal burden being carried by my liver.

Lead was determined to be the offending metal, by hair analysis. Although the lead was not at a poisonous level, it was more than twice the average level (for a city dweller) for adults in our society. My level was 16.7ppm. Lead poisoning is deemed to occur at 20ppm.

I was informed that I may not feel the effects of the poisoning for as much as another 15 or 20 years; after which my liver and other organs would possibly cease functioning. This information caused me to seek help instantly. An infusion of amino acids and vitamins has eliminated the lead from my body. This therapy is called Chelation Therapy, and is expensive and inconvenient since it not available under Medicare.

Many of my fellow patients received their high lead levels through plumbing activities or paint (lead based) stripping. One fellow from Telecom (severely disabled) had a very high (30ppm) lead level.

I now use 99%-tin solder and a fume extraction system for my workbench. I would add that my lead load may have arisen from other environmental factors, such as lead from car exhausts. It is difficult to determine, as humans have differing abilities to deal with toxic metal poisoning.

I would think that it is common sense for people working with lead based products to be tested regularly for lead poisoning. I was tested in Sydney by Australian Biologics. I am sure there are others in this field offering a similar service.

I trust that the foregoing is of interest to yourself and your readers.

Well — your letter is certainly of interest to me, Trevor, and I'm pretty sure it will be to a lot of other people in electronics as well.

Personally, I found it quite sobering, because if Trevor turned out to have a seriously high level of lead in his system, I suspect many of us may be in the same metaphorical boat. For example I've done quite a lot of soldering myself, over the years, and still do a fair amount. Like Trevor I also do quite a bit of driving, often in peak-hour traffic; so one way and another, I guess *my* chances of acquiring a worrying level of lead are likely to be much the same as his.

All of which suggests to me that I'd be wise to have a lead test done myself, at the earliest opportunity. How about you?

Anyway, Trevor, many thanks for your contribution to the discussion — even if it has given many of us a cause for concern. In fact if your letter prompts even a few of us to get tested, and as a result we're able to reduce any excessive lead levels in time, you'll clearly have done a lot more good than merely contribute to Forum...

Touch lamps & RFI

Changing topic once again, I've received an interesting letter from George Neilson VK3TES of Blairgowrie in Victoria — the same chap who gave Neville Williams so much help recently with the story on Howard Kingsley Love and Kingsley Radio. This time, though, Mr Neilson wants to draw our attention to a couple of subjects; one is RFI from touch-sensor lamps, and the other is RFI filters in personal computers, and their safety aspects.

Anyway, here's what George Neilson has to say:

I would like to make a contribution to the 'Forum' discussions. Recently we purchased a 'Touch Lamp' for the bedroom. Now it so happens that we listen mostly to 3AW Melbourne on 1278kHz, and this lamp generates a very loud mains-modulated carrier right on top of 1278kHz — so much so that the lamp has to be disconnected from the mains before we can listen to the radio. There are other minor interferences, but this one is by far the worst.

Have you had any reports on these lamps, and/or has EA carried out any tests on them? Also do they contravene any broadcasting regulations?

Further, I purchased a 'Kambrook Shocksafe' Residual Current Device,

Cat. No. SG30, to give me some protection in my workshop. This is double pole rated at 10 amps, and has an 'I delta n' of 30mA. It plugs into the standard three-pin power outlet and has a three-pin socket, and supplies the power to my workshop.

The first time I used the device it tripped as soon as I turned on my computer. This led me to test the power input of the computer, and on an ohmmeter test I could not find any resistance to ground up to 20 megs.

I then applied about 8V 50Hz between active and earth and neutral and earth, and measured about 2mA of alternating current in each. This tends to confirm my deduction that there is an RF filter circuit in the mains input of the computer with capacitors from each lead to ground. Would you like to make any comments?

I have not seen any reference anywhere that these devices are not suitable for use with computers, and there are many places where this device is part of the house wiring. In my case I have been able to bypass it, but I am concerned that my computer may be infringing some mains power regulations.

Thanks for those items, George; they're certainly interesting. I guess I've never paid much attention to touch-sensor lamps myself, and I don't have any direct experience with them. We described one or two many years ago, but not recently. To the best of my knowledge, we haven't done any tests on them in recent years, and I haven't seen any other reports.

Internal oscillator

I believe most of them do use an RF oscillator as the sensing circuit, with the touch plate or metallic lamp body coupled to it so that additional capacitance from the user changes either the frequency or activity of the oscillator.

If this is the case, there must be *some* radiation of oscillator energy, and this creates the possibility of the kind of interference problem you describe. But on the other hand, I'd be surprised if there wasn't an official standard for the maximum radiated energy, so that any lamp sold legally in Australia would presumably have to meet the standard.

I'd imagine, though, that even a lamp which met the official standard could still produce the kind of RFI that George describes, in the right/wrong combination of circumstances. For example, when it was in close proximity to a radio with a barely adequate antenna system, trying to receive signals that were already fairly weak...

I don't know exactly where Blairgowrie is, in relationship to Melbourne, so I can't tell whether this kind of situation could apply in George Neilson's case. But perhaps there's a fair distance between his set and 3AW, and like many modern bedside radios his set may have a fairly modest ferrite rod antenna. This might well result in the RFI problem he describes, even with a lamp whose radiation was below the acceptable level.

What could be done to fix the problem? Well, for a start I'd try providing the set with a better antenna, so that it had more signal to work on. If the problem still persisted, I'd try moving the lamp to the other side of the bed. And if *that* still didn't solve the problem, I'd change back to a lamp with a simple and old-fashioned manual switch!

Computer line filters

Now to George Neilson's other item, about line filters built into computers. This is one I *have* had some experience with, and it's a thorny subject.

My understanding is that Australian safety standards specify a maximum capacitance value for RFI filtering in any equipment, from either side of the mains to earth. It's based on a maximum AC current figure, as I recall, and to the best of my memory this equates to a maximum of 10nF total from either active or neutral to earth. (Sorry, I don't have easy access to the standards, to quote the exact chapter and verse.)

Now although this is the case, my impression is that quite a few of the personal computers (and possibly other gear as well) sold in Australia have *considerably higher* capacitance values built into their internal line filters.

A couple of years ago I checked one of my own machines, an Epson AX-2, and from memory it turned out to have 0.27uF capacitors in the filter. They were actually fitted on the *mains* side of the power switch, so they weren't even switched out of circuit when the computer was turned off!

I only discovered this when I tried using a master/slave switching box to switch on my laser printer when the computer was switched on — and found that the switch box wouldn't turn off. The box used a triac sensing the current drawn by the 'master' appliance, and in this case the current drawn by the filter capacitors was enough to keep the triac on permanently.

So I suspect you're not alone, George. Many people are likely to have similar problems, if they try using an RCD with their computer. It looks as if quite a few computers have fairly large capacitors in their mains filters; just how these computers have been able to be approved for sale, I'm not sure.

Only one possibility springs to mind: a computer, or any other piece of equipment using a switch-mode power supply, generally *needs* a fairly effective line filter to reduce its own radiation of switching hash. So perhaps computer makers have been caught in a bind, trying to meet RFI/EMI radiation standards while still remaining cost competitive.

It may be that those big line filter capacitors are the only way they've been able to meet the radiation specs. A sobering thought, isn't it?

And that's all for this month and for 1994. Thanks to everyone who contributed items this year, and I hope you'll join me in the Forum again, next year. ❖

AUDIOPHILES !

NEW PRODUCTS FOR 1994
NEW all Valves Preamplifier see Oct. Issue and Power Amplifiers, 6L6, EL34, KT88 kits at competitive prices. High quality CDs from Chesky, Mobile Fidelity, etc,.

Other products include:
Kimber caps and cables, MIT caps, Cerafine caps, Holco resistors, High Quality Valves, ALPS Pots and many others

Send $1.00 stamp for NEW 1994/95 Product Catalogue
PHONE & FAX: (03) 807 1263
CONTAN AUDIO
37 WADHAM PARADE
MT. WAVERLEY, VICTORIA 3149

READER INFO NO. 9

Discover
ASTRONOMY
with Australia's finest Astronomy & Space magazine
Southern SKY

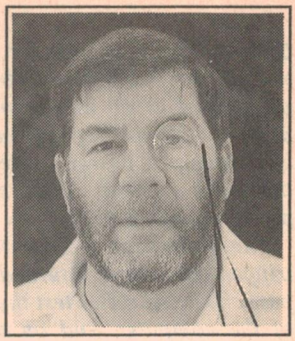
Radio Astronomy
Telescope Control
Electronic Imaging
Instrument Building
Equipment Reviews
Astronomer Profiles
Stunning Photographs
News, and much more

ask your newsagent or subscribe to:-
Southern Sky Press
PO Box 3686
Weston Creek ACT 2611
editor@southsky.com.au
Ph: (06) 288 5162
Fax: (06) 288 1277
in Australia: $27 for 6 issues, $54 for 12 issues

READER INFO NO. 10

Moffat's Madhouse...

by TOM MOFFAT



Is Telecom's security too lax?

If you were going to conquer a country, where would you start? Mass an army off that country's shores? Torpedo its navy? Or just drop a nuclear bomb and be done with it? The most likely answer is 'none of the above'. Modern warfare is, and will continue to be, conducted along much more subtle lines.

If you apply a little thought to it, invading a country is no real problem, even if your resources are somewhat limited. No nukes? No worries! If the country is somewhat isolated from its neighbours , as is Australia and even more so New Zealand, the job is even easier.

The first thing you would do is disable the country's communications system. Next, you would disconnect their power grid. Then you could just walk in and take over. Nobody could raise the alarm if their communications was kaput. And with the power out, they couldn't see where they were going anyway. Things would be easier still if you put a little something in their water supply so they were all stoned when you got there. There you have it, the Moffat's Madhouse Plan For Global Anarchy, or MMPFGA for short...

Actually this isn't as silly as it sounds, and governments for years have been planning against just such contingencies. Telephone systems are supposed to be secure, and you just try to get into the main control room for a power system.

I did get into a control room once, of Victoria's SEC. This was to cover some news story or other, but in the midst of the proceedings the boss-man proudly showed us a big switch, saying "If we throw this, it cuts off the whole state". Silly me, I responded with "Can I give it a try?" The boss just about chucked a heart attack on the spot, and Tom was unceremoniously sent home. They were not impressed.

I'm somewhat more familiar with communications systems, having spent several years working for Ma Bell in the USA. Although officially a technical officer, a lot of my time was spent in an activity called 'protection', acting as kind of a techno-guard to ensure no damage came to the telephone system. All the techs did this duty on a rotation basis, keeping a watchful eye as contractors dug holes near critical installations or poured concrete.

At this time America was in the grip of the Cold War, and defence officials were pretty paranoid about the communications system. They were worried that, should a 'quiet' invasion take place, the telephone network would be the first target.

My first experience with this came in 1962 during that grim time known as the Cuban Missile Crisis. I was working for the Long Lines section of the American Telephone and Telegraph Company at Tucson, Arizona. This hot dusty town was the home of Davis-Monthan Air Force Base, one of the most important outposts of the Strategic Air Command. A large fleet of B-52 bombers was stationed at the base and, we suspected, it was also the home of many nuclear bombs.

One day I went out for lunch, which for me usually meant a prowl through the city, walking and relaxing. I came to a large department store and there in the window was this tiny 5" portable TV set. I immediately fell in love with the thing, and I stood there looking and drooling. President Kennedy was on the screen making a speech but I didn't care — I'd watch anything on that snazzy little TV set.

But then I heard what the President was saying. The guts of it was that if Russia didn't get out of Cuba, the USA would blow them out.

You could see just from the expression on Kennedy's face that this was bad business. So I decided to head back to work early, and sit at my desk and brood about it. But when I got back to the telephone office, less than 20 minutes after I'd left, the place was surrounded by army troops — with guns. I headed for my usual door and this guy stomped one step sideways, into my path, and pointed his rifle at my chest. You would not know what this is like until it's happened to you.

I told the soldier I worked there. No go. I showed him my phone company ID. No go. Eventually he agreed to call my supervisor down to see if I was who I claimed I was. And *that* did the trick, although by then I didn't feel much like going to work any more...

The reason that scene got so heavy, so fast, was that every communications line to and from the Davis-Monthan Air Force Base ran through that central office. And I guess they remembered the good fright we'd given them a few months before.

Earlier scare...

The Air Force circuits were so 'hot' that they had little beeps sent along them every three seconds to verify their continuity. If the beeps failed, it was an indication of suspected attack. Before you could do any work on one of these circuits, you had to ring a very senior fellow at the base, tell him which circuit you wanted to work on, how long it would be down, and what your name was. He would consult a higher authority and then ring back a few minutes later, authorising a 'release'.

When you were done working on that circuit you would test it with the Air Force, officially hand it over to them, and then request a 'release' on the next one. So it was only permissible to have one circuit down at a time.

That is, of course, unless you were a young technician named Karl. He had the German penchant for efficiency, and he reasoned that he could get his job done a lot quicker and easier if he bypassed all the red tape and went after the Air Force circuits in wholesale fashion. He'd work on the whole lot at once and have them back up again before they even missed them. He totally forgot about, or ignored, the matter of the beeps...

So Karl began pulling down circuits, a fistful at a time, and out at the Air Force

base alarm bells rang as red lights came on, a fistful at a time.

ALL the circuits were going haywire simultaneously. It was obviously nuclear war. So the B-52's were scrambled, the nukes were armed, the world waited, and Karl sat there on the floor of the central office pulling out more jumper wires.

Before long the Air Force comms officer found the time to ring the phone company to report that his circuits were failing. But we already knew — because *we* had alarm bells and red lights too. And then somebody found Karl, with his hand full of disconnected red and white wires. The supervisor made some unseemly remarks and Karl was sacked on the spot. Appropriate apologies were made to the Air Force, who called back the B-52's before they were able to start World War III.

Happily the defence department realised that Karl's aptitude for sensitive communications work may not have been representative of the whole telephone company; they understood that their real threat came from the outside. So a program was begun to 'harden' certain critical telephone installations, so they could withstand nuclear war and keep on working.

Instead of building new buildings, the method was to build a concrete 'shell' around an existing installation. So contractors would pour walls of foot-thick reinforced concrete just outside the existing walls, and then pour a foot-thick roof on top. Any time this work was going on there would be a telephone company tech officer standing by, doing 'protection'.

I had to put my job on the line once over this. I was working at a mountain-top microwave repeater site that was being 'hardened'. The contractors had got to the stage where they were pouring the new concrete roof on top of the existing one. As you probably know, once a concrete pour starts it must never be stopped or the concrete will not be uniform. So the contractors had organised a continuous shuttle of Redi-Mix trucks to chug up the mountain road, each carrying its own little contribution to the overall roof.

I was inside, baby-sitting the equipment. At one stage I heard a quiet creak, and then another. I looked and looked to see where it was coming from, and finally noticed that the framework holding one of the equipment racks, which was normally fixed to the ceiling, was now poking up *through* the ceiling. The racks weren't going up, so the ceiling had to be coming down — hey!

"STOP THE POUR! STOP THE POUR!" I was out of that building in a flash.

"Whaddaya mean, stop the pour?" I told the foreman to stop that truck NOW, the roof was falling in.

"BULL****" was his response. "You know we can't stop a pour!"

I had to point out that I was the final authority on that site, and if he didn't stop the pour, I'd get the cops up there to stop it for him. And he responded that he would ensure I was sacked by that afternoon.

So I told him to go ahead and get me sacked, but STOP THE POUR. And the guy got on his radio to get me sacked; but his boss was a little more aware of the consequences that might arise from his company crushing a telephone office. So the pour was stopped. Soon the phone company's structural engineers were on the scene with some wind-up jack things to shore up the roof from inside. Then the pour resumed, successfully. But that was a close call...

In Australia I guess we're not so paranoid, because you don't see many telephone installations that look like concrete bunkers. But does that mean our communications are not in danger of attack? One wonders.

What got me thinking about this whole business was an incident several months ago in which vandals attacked the Bellerive telephone exchange near Hobart. Apparently they were able to get through the fence to an unlocked Telecom van. The keys were still in it — along with a key to the cable pit where all the underground phone lines enter the central office.

They easily opened the cable pit and then descended therein, axe in hand, to wreak considerable havoc upon the not inconsiderable collection of big fat Telecom cables. As they hacked away, something like 13,000 subscribers yelled "We've been cut off!"

With their nefarious deed done, the villains crept off into the night. But it reportedly took several hours before anyone discovered why nearly every phone on the eastern shore of the Derwent went dead. There was concern that the big phone-chop was in preparation for some major crime (remember, disable their communications first...). But nothing eventuated.

Telecom said it could be a couple of weeks before all service was restored, but their techs pitched in with a vengeance and had the whole works back on the air in a couple of days. As for the saboteurs, they are still at large, despite generous rewards being offered.

How was this allowed to happen? The cable pit is the most vulnerable part of any telephone office; that's where its whole reason for being comes together. In Ma Bell's case, the cable pit is called the cable VAULT, because it's made just about impenetrable. Most of them don't even have outside entrances; you can only get into the cable vault from within the building. Yet here in Australia it is possible to hop a fence, grab some keys, unlock the pit, and go for it.

But cable pits are small beans, compared with the havoc someone could cause at a microwave relay site. What comes and goes from local exchanges like Bellerive are only capillaries. The microwave sites carry the arteries through which a country's life blood flows.

And in Australia they look pretty vulnerable. This morning I did a little inspection of my own of a Telecom microwave site. I arrived at the site on foot, and found it totally deserted. And should I have desired to prepare Tasmania for conquest by disabling its communications, it would have been a snack.

Just by standing outside looking through the fence, I worked out how to put the site out of action in 10 minutes flat, using a method that would be very difficult to discover. I could do it, and be gone, and nobody would be the wiser regarding how it happened or who dunnit.

It would be irresponsible to describe it here, but I reckon any person with electronic knowledge would come up with the same idea pretty quick smart, if he were intent on disabling a communications system. In fact I told a very senior technical acquaintance I was writing this article, and it took him all of 30 seconds to work out a scheme involving the total destruction of the station's antenna system using fire.

Is this important? Would anyone, other than a crank vandal, want to nobble the telephone system in Australia? Should we think of 'hardening' the system? It certainly doesn't appear very 'hard' now.

I haven't asked Telecom about this, because I doubt they'd want to say much about their security — especially if the information were to be published in a column named 'Madhouse'. But I'm sure, especially after the Bellerive incident and an earlier one in Sydney, they're thinking hard about security. In today's world you can't afford to ignore it.

By the way, I'm going to be away in the USA between December 14 and January 16, collecting raw material for some more stories in *EA*. So if you want to assemble any of my kits over your Christmas break, you'd better get them before I go. Have a good Christmas! ❖

THE SERVICEMAN

Amazing that it worked at all!

Among the stories I have for you this month is the tale of a 'noisy' mantel radio that when opened up, turned out to have a problem so drastic that it's hard to understand how it had ever worked at all. There's also an amusing account of a set that seemed to stop working whenever the service technician was in the house — with a different fault each time...

Our contributors have been very busy with typewriters and word processors lately, so this month I'm handing the whole column over to them. First up is A.L., from Beverly Hills in NSW.

We've heard from A.L. before, you may recall, with his stories of alarm system installation and service. He has sent me half a dozen new stories covering security systems and professional telephone networks, all of which will appear in coming months.

In the meantime, he is back with details of another alarming situation. He calls this one 'The Hygroscopic Detectors':

In the security industry, the most dreaded event is not the false alarm. It is the failure of the alarm system to detect an intruder, and the possible litigation that could result from such an event. To ensure that an alarm system is fully functional, rigorous commissioning and routine testing standards are employed.

As part of this philosophy, the alarm installation is commissioned by a qualified engineer or senior technician and a full test report is included in the customer file. These reports are examined by senior management and any failures are thoroughly investigated.

In this case, five passive infrared detectors in the basement of a new building failed to detect during the commissioning tests.

The detectors were replaced, and the installation then tested OK. The faulty units were sent to the electronics lab for further investigation. These units all tested OK, when subjected to a chopped infrared source. In fact they all met the manufacturers test specification.

The commissioning engineer was called into the office and questioned, but was unable to give any explanation for the failures. A site investigation was arranged and when the basement area was retested, horror of horrors — three of the new detectors now wouldn't detect.

Two of these units were removed to the electronics lab and tested. Both failed to detect the chopped infrared source when first placed in the test fixture, but after they had been operating for five hours they gradually began to detect and eventually met the test specification.

The building contractor was asked if anything unusual had occurred during the construction of the building, and he told us that the basement had been flooded during the early construction phase.

This had occurred some months before the alarm installation had commenced, so our on-site personnel would not have any knowledge of the flooding.

This did give us a clue to the possible cause of the problem, so back at the lab we placed two of the original detectors in an environmental chamber and gradually increased the relative humidity while monitoring the output of the integrator stage. As the RH increased, we observed that the integrator gradually developed an output offset until it saturated.

Cycling the chamber with dry air and increasing the temperature reversed this effect. RH was definitely the cause — but what was detecting the humidity change?

We recycled the chamber until the fault reappeared on both detectors, and then removed one for dissection — literally, because electromagnetic shields had to be removed to get to the trackwork of the PCB. Under the integrator capacitor, a 4.7uF block polyester, we found a smudge of flux. Checking this with a high range ohmmeter proved it to be the unintentional humidity sensing element.

This problem arose because the manufacturer had complied with new regulations banning the use of CFC solvents, and had changed over to water soluble flux and water washing of the assembled printed circuit boards. The 4.7uF block poly capacitor had trapped the hygroscopic flux under its footprint, in a high impedance circuit; with catastrophic results.

Fortunately we were able to identify the manufacturing batch numbers affected and initiate a product recall, before many units had been installed.

Thanks for that story, A.L. It was not only interesting from the security system angle, but also as a warning about a fault that may become more common in other equipment as well. In these days of environmental concern, water soluble flux is becoming much more common and PCB's of all kinds will be prone to moisture problems. It's something to watch out for, so thanks again.

More insects...

While we are on the subject of security systems, and harking back to one of A.L.'s earlier stories, here is a short yarn from a New Zealand reader on a very similar occurrence. It comes from B.H.

Spectrum Analysis..

..with an abundance of extra features and a reasonable price.

Aerial Industries HP2-TS



Peter C. Lacey Services Pty. Ltd.

80 Dandenong Rd. FRANKSTON 3199

Tel:(03) 783 2388 Fax:(03) 783 5767 ACN006893438

READER INFO NO. 12



of Eastbourne, and as you will see, it points to the need for technicians to study entomology if they are going to get involved in security systems, etc. B.H. tells the story thus:

Going back a few months to a story a contributor told about ants in a security system, that reminded me of a similar entomological nightmare — literally!

The system concerned had been installed in a local club and was used to protect the bar area. The main unit was a microwave movement detector and this was causing all the trouble, by tripping every morning around 2am.

We fitted a new unit and the trouble went away for a week or two. But then it was back, again at 2am!

This time we checked the microwave unit very carefully and found, in the space between the waveguide and the outside face panel, cockroaches of every size. If you can imagine what a large cockroach moving in front of the waveguide would look like to the detector, it's no wonder that the alarm was going off.

A few weeks later, I was telling a friend about the problem when he remarked "Didn't you know that cockroaches are most active between one and three am?" Now he tells me!

Well, I did say it was a short story! But seriously though, it does point up the need to know something about insects and their effects on electronic equipment.

As an example, I think I might have told the tale of the touch- tune TV that kept changing channels. All the usual cures, such as cleaning the touch pads could only cure the problem for an hour or two. Finally, the owner's young son solved the problem when he spotted a tiny beetle walking over the pads. Each time the insect bridged the contacts the channels would change.

A squirt of insecticide cured the problem permanently. It's the only time I have ever fixed a TV with Mortein! Thanks, B.H.

100% faulty!

In fact, we are not finished with B.H. just yet. He submitted another short (although not quite so short!) story which I think you will find amusing. See what you think:

Then there was a fault that really wasn't a fault.

A client brought in a small mantel radio, saying that it was "...very noisy". This must have been the understatement of the century, since even a feather falling within five or six metres of the set caused it to have an electronic heart attack.

It was a steam-age radio and every valve responded to the slightest touch. Just touching the tuning knob sent the set into paroxysms of crackling and banging. It was so noisy that you couldn't tell whether it was tuned to a station or not!

I suspected that it was a dry joint — but I could never, in my wildest dreams, imagine what I eventually found when I got it out of the cabinet.

It was a dry joint all right. In fact, lots of them — 100% of them. No soldering iron had ever been anywhere near this set!

I rang the manufacturers and described what I had found. They were surprised and delighted to hear from me, since they had been looking for this particular set for several years. It seems that it was a sample, used on the wiring line to train staff, and somehow it had escaped among other similar production models. The thing that amazed me was that it actually worked for years before being brought in for service.

The company gave the client a new, similar radio, so all ended well for them. But I missed out on the service job!

How about that? From time to time most of us have found the odd joints that missed the soldering operation during manufacture — but every joint!?

I don't know about you, but I was greatly amused by the image of that set desperately trying to 'escape' from the factory and finally getting away in a shipment of similar sets. I've worked on the wiring line in a radio factory, and I wanted to escape to the outside world too. But I didn't think about getting myself shipped out with the product!

But enough foolishness. Thanks for the story B.H., and I hope your fee for telling it compensates in some way for the loss of the job.

Poor communication

Now we come to a story with a twist — it's told from the customer's viewpoint. J.W. is a retired electronics technician, but not a serviceman. So when his TV broke down... but I'll let him introduce the story:

Talking about jumping to conclusions reminds me of an occasion when I took my old Philips TV in for repairs.

I had worked out that the set's tuner was intermittent — probably a dry joint around the local oscillator, since it kept popping in and out of tune. When it was OK, the fine tuning control worked properly, but when it went off, the fine tuner could not pull it back.

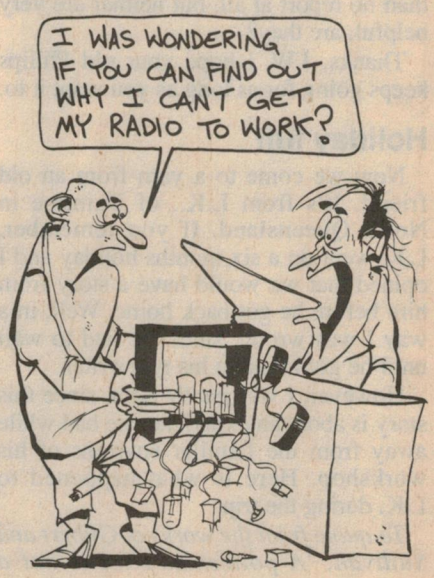
I wasn't confident enough to get into the tuner, and since the local TV serviceman had the tools and expertise to do the job, that's where I took it.

I explained the symptoms and my diagnosis to the receptionist, and although she took down my name, address and phone number, she didn't make any notes about the fault. I suggested that she should at least take down some of the details, but she appeared to have no interest at all.

Some days later I received the set back with a bill for labour, some parts which I was unable to see and a statement offering a three-month guarantee on the job. When I got it home, you might have guessed — the set was still jumping off frequency.

So it was back to the repair shop and again I described the fault and suggested where it must be. And once again the receptionist took no notes!

Several more days passed and I had a



call that the set was ready. There was no charge for the second job and it was brought out to the counter by a friendly technician type — the one who had done all the work on the set.

I asked him "Tuner oscillator?" and his reply was "Yes". So I continued with "Faulty connection? Dry joint?" and his response was "Dead right! Just a touch with the soldering iron for an instant cure. But it took me a hell of a long time — bloody hours to work it out and then more hours to find it!"

I suspect that was a bit of an exaggeration, but I can appreciate his frustration in trying to find an intermittent fault, without knowing anything about its nature or history.

It just happened that I was lucky enough to jump to the right conclusion, and the serviceman could have saved hours of fruitless labour if my diagnosis had been passed on.

That receptionist could have saved lots of customer frustration and wasted time for herself and the serviceman, just for the want of listening and taking notes. But then, perhaps she thought that anyone with gray hair couldn't possibly know what he was talking about. Or worse still for all concerned, that customers don't know anything anyway!

You know, J.W., your story reminds me just how lucky I've been over the years. In all that time I've been a one-man-band and have always spoken directly to the customer. But I've seen job sheets filled out for colleagues by counter staff of varied skills. One young woman couldn't spell 'intermittent', so she wrote 'stops and starts when you bang it'. I suppose that would be better than no report at all, but neither are very helpful, are they?

Thanks, J.W. I hope your old Philips keeps going for as long as you want it to.

Holiday fun

Now we come to a yarn from an old friend. It's from L.K., of Daintree in North Queensland. If you remember, L.K. went on a six months holiday and I opined that we would have a story from him before he got back home. Well, in a way I was wrong, since we had to wait until he got home to his typewriter.

However, I was *partly* right, since this story is about an experience he had while away from the familiar environs of his workshop. Here is what happened to L.K. during the trip:

To quote from the works of Gilbert and Sullivan, 'A policeman's lot is not a happy one'! Servicemen and police seem to have one thing in common, in that they are never really off duty. And so it was for me on a recent holiday with Mrs L.K. when, due to circumstances over which I had relinquished control, it became my lot to spend a few days with my mother-in-law!



Almost upon arrival I was presented with a clock radio which, I was informed, had gone mute just as I drove up. The implicit command was "Fix it!", and I was left in no doubt that this was to be my entry fee to the Dragon's lair.

While I can't vouch for other tradesmen, I find it easier to carry a few basic tools with me at all times rather than be caught trying to remodel our techniques with a hair clip and nail file.



This time I was in luck. I traced the circuit to an open contact in the earphone socket, which had isolated the speaker. The spring contact was accessible, so I carefully levered it past its opposite number until it was retensioned, and then slid it back into position. (This was a neat and rapid repair that CAN usually be accomplished with a hair clip and a nail file!)

Now I was in the door!

Next morning, as M-I-L perambulated in to breakfast, the words "It still doesn't work" announced her continued existence.

My first thought was that the sleight of hand I'd used the day before was a failure, but thankfully, not so. She had apparently wanted to listen to a favourite programme during the night and, not wishing to disturb her guests, had plugged in a set of headphones. Removing them brought the set back to life. I subsequently mended the headphone lead, which had broken in the usual place, just short of the plug. My reward was a curt nod of thanks and the rest of that day was uneventful.

Early the following day saw me thumbing through the local rag and about to enjoy a breakfast snack, when "It still doesn't work!" again bored into my brain, collapsing my composure for the second time in 24 hours.

"He'll have a look at it right after breakfast", Mrs L.K. announced, before I had time to return the service. In utter disbelief I went to check for myself, but alas it was true; as dead as a month old corpse. I may have exhibited just a touch of impatience as I bundled up the offending device and headed for the sanctuary of the shed.

Laid bare on the bench, a few minutes with the multimeter suggested that the beast ought to be working, but wasn't. There appeared to be audio at the output of the final IC, but nothing at the speaker, and the speaker tested OK. Between the IC and the speaker there was only a 470uF capacitor and the earphone socket. Since the latter had been attended to on my arrival, I now suspected the capacitor — and so it proved to be. As open circuit as the headset lead had been, only a day earlier.

So the next scene has me seeking out the nearest TV serviceman, to purchase a replacement capacitor. Then once again the set was brought to life, assembled and returned to its usual place. An explanation seemed superfluous, since the

atmosphere clearly suggested that it was simply my presence in the house that was causing all the problems!

That day passed without any more angst and next morning, convinced that all must be right with the world, I fronted for breakfast a little later than usual. Just as I was poised to park my posterior in its allotted place, that now dreaded phrase "It STILL doesn't work!" thundered throughout the house. It shook my serenity to pieces, and damned near cracked the shell of my soft boiled egg!

"All I can get is static." The words stabbed at me from a mouth rigidly attached to a double chin.

"If it's a broken dial cord," I mumbled, heading for her room to investigate, "I'm leaving for home!" Fortunately, the cord was intact; yet the set would produce nothing but hash on the AM band. Changing to FM brought the set back to life. It seemed reasonable to assume that both bands shared a common IF strip, so a failure of the AM local oscillator would be the most likely cause of this sort of breakdown.

As the covers came off once again, I hoped that the front end had been constructed from discrete components, rather than as a part of an IC. If it was an IC, a replacement would be out of the question, at least in the short term.

For once, I was in luck. Three transistors — with no meaningful numbers — inhabited the tuning area. Two appeared to be associated with the VHF stage, while the other one served some other purpose. I measured voltages around this third one and found 7V, 3V and 0V, so unless there was a defect causing some radical change in operating conditions, the device was not drawing any current and must logically be faulty. Given a positive supply rail, I decided to fall back on the old faithful BC548 as a trial substitute.

So it was back to the TV man again. The trip took longer than expected this time, since we had become quite matey by now and I was invited to share in his coffee break. He was a jovial chap who had some good tales to relate. (Aren't ALL servicemen jolly chaps with good stories to tell? — Ed.)

Back at the ranch, that BC548 did the job; the AM burst forth with even the alignment remaining spot on! So once more the set was repositioned in the Dragon's lair.

That was the final event in the saga. Had a couple of the breakdowns occurred simultaneously, a lot of time and trouble would have been avoided, not to mention the crimson looks from M-I-L. Unfortunately, things never seem to work out so conveniently in real life. Looking on the bright side, if one can be found, I should be grateful that this did not happen to a paying customer. In my experience they just do not want to understand.

This had been one of those LOVE jobs (ones that call for 'Lots Of Voluntary Effort') but I wonder if four faults in four days, producing four similar symptoms (at least as the owner sees it) has not set some kind of a record.

I agree, L.K. — that's a record that is not likely to be beaten for a while, at least. Thanks for sharing it with us, and I hope you found the rest of your holiday more relaxing than those four days with mother-in-law.

Incidentally, L.K's covering letter assured me that the Dragon had vetted the story and was quite amused by it. It seems that he need not be afraid to return to the lair, at some time in the future...

And that's all for this month. I'll be back next time with more stories from my bench and yours. ❖

TIMMTA

RFI SUPPRESSION FILTERS

Conforms to IEC 950



- Conforms to IEC 950, IEC 664 categories I, II & III and IEC 801-5
- IEC inlet with 1- 2 - 4 - 6 - 10 amps rating
- Surge voltage immunity of 4kV according to IEC 801-5 guaranteed
- Small size with case length of 44mm for FGS & 54mm for FGX
- LOW COST & high performance using new construction technology
- Large range of filter styles to choose from
- Approvals

Fastron TECHNOLOGIES PTY. LTD.

Ph (03) 794 5566

Fax (03) 794 6670

AGENTS IN ALL STATES & NZ

READER INFO NO. 13

Pocket DMM with 3200 count display and bargraph



- Ultra compact size for one-hand operation
- Data Hold function
- High speed auto-ranging
- High speed sampling: approx. 12 times/sec. for 32 segments bargraph
- Auto Power Off – doubles battery life

Brief Specifications

Digital Display : 3.5 digit LCD reading of approx. 3200 and annunciators, approx.2 times/s sampling

Bar graph display : 32 segments, approx.12 times/s sampling

Ranges :	Auto ranging
Vdc :	300mV, 3, 30, 300, 450V
Vac :	3, 30, 300, 450V
Ohms :	300Ω, 3, 30, 300kΩ, 3, 30MΩ
Auto Power Off	The meter is powered off 10 minutes after last operation

Model 7536 $75 ex tax

Lloyd's Register Quality Assurance to ISO-9001

one of the NEW Generation of Multimeters from

YOKOGAWA

Centrecourt D3, 25-27 Paul Street North, North Ryde

Call Robyn for more information on (02) 805 0699 or fax : (02) 888 1844

READER INFO NO. 14

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Telephone ring simulator

The circuit provides a reasonable approximation to the telephone ring cadence most usual in Australia: 400ms on, 200ms off, 400ms on, two seconds off. It's based on the 556 dual timer IC, but is easily modified for its cheaper equivalent of two 555s. Timer 1 oscillates in a two second low, one second high (and repeat) cycle to get the overall three second cycle. Timer 2 does the 400/200/400ms sequence, with its repeat action suppressed by timer 1 during the two second phase.

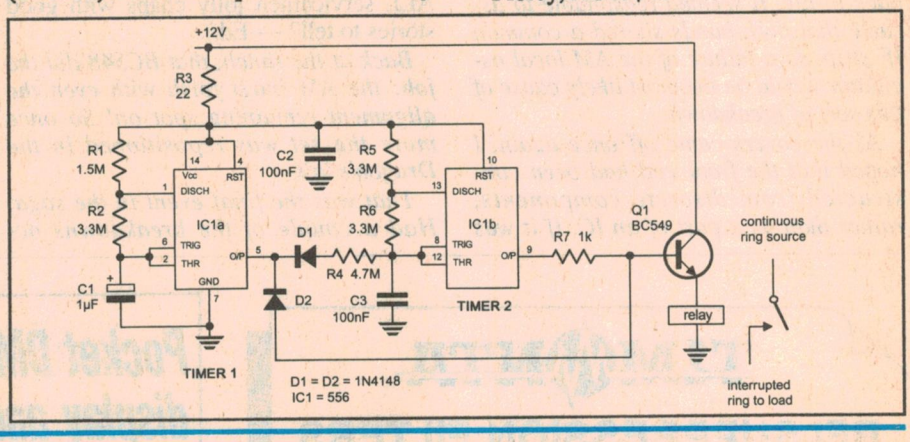
There could be timing irregularity if the foregoing simplified description were entirely true, depending on the accuracy of the match between the one second phase of timer 1 and the 400+200+400ms of timer 2. This is avoided by designing timer 1 to cut out after two 400ms phases of timer 2, but before a third can start. This is done with a diode/resistor (R7 and D2) AND gate to take output from an appropriate combination of both timer output signals.

Another necessary refinement is D1 and R4, to hold timer 2 a little below the threshold voltage during the two second phase. This is to halt timer 2 so its output is high but ready to commence its action with a minimum of delay when timer 1 goes high to start the one second phase. Other methods of halting timer 2 are liable to prolong its first 400ms pulse.

The decoupling provided by R3 and C2 is to avoid any noise problem from the chip's totem-pole crossover current pulses. I strongly recommend removing the (unused) reference pins 3 and 11 by repeated bending. This removes a possible path for noise.

The output relay would usually be a cradle type of appropriate coil voltage, typically in the range of 200 to 900 ohms for a 12V supply. The emitter-follower isolates the AND gate from the relay load and controls the inductive effects of the relay winding. Of course, a solid-state switching device could be used instead of the relay to control the actual ringing current.

E.G. Wormald,
Florey, ACT. **$40**



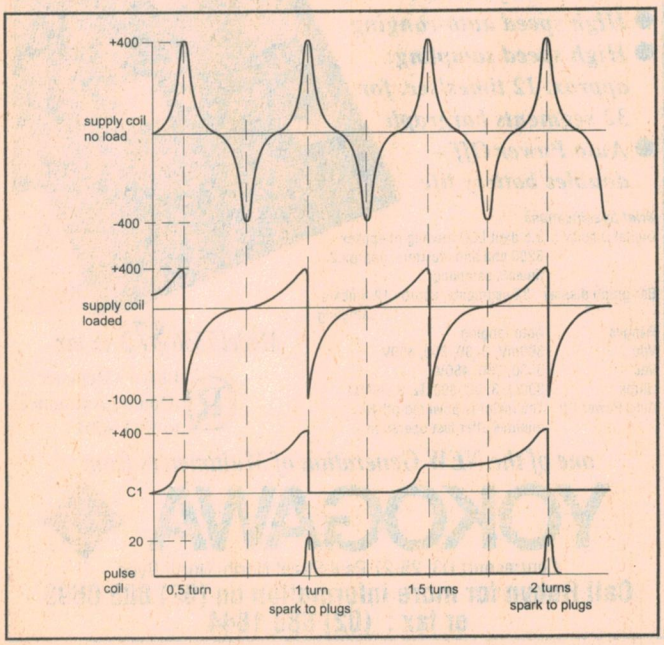
CDI for an outboard motor

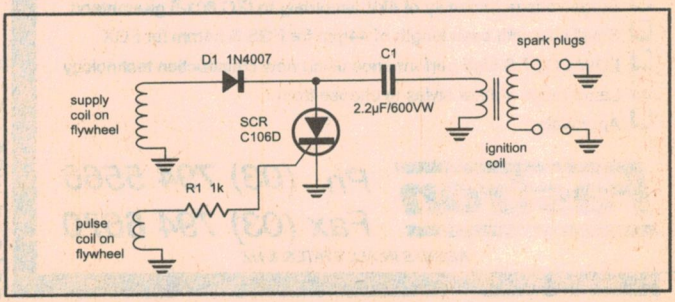
This circuit can be used as a replacement for a CDI unit on an outboard motor. The supply coil gives 400Vp-p pulses when the engine is cranked. This voltage is rectified by D1, and C1 charges to 400V DC via the primary of the spark coil.

In my case, the engine was a two cylinder four stroke, hence the two plugs connected to each end of the secondary of the ignition coil.

The pulse coil in this engine gives a 20V pulse with each crank. This pulse is fed to the SCR via R1. When the SCR fires, it allows C1 to discharge via the primary winding of the ignition coil. This creates a high voltage in the secondary of the coil, giving a spark that occurs each revolution at both plugs, firing one cylinder on one of four piston strokes, the compression stroke, then the other cylinder two strokes later on its compression stroke. The waveforms show the timing and voltage values of the various pulses in the circuit.

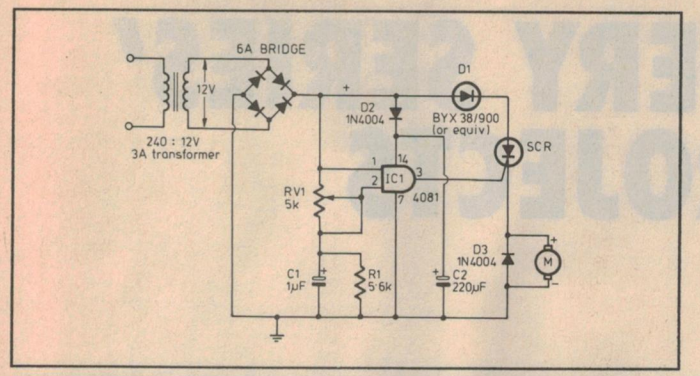
D.T. Francis,
Cannonvale, Qld. **$40**





Speed controller for DC motors

This circuit is used to control a windscreen wiper motor with an integral gearbox and an output shaft speed of about 60rpm. It gives full, or near full output power down to about 5rpm. One input of a 4081 AND gate is connected to the rectified, but unfiltered DC supply from the bridge rectifier.



The other input is connected to the same source, but via a variable phase delay comprising RV1, C1 and R1. The output of the AND gate directly controls the gate of the SCR, which in turn controls the motor speed. A filtered DC supply for the 4081 is provided by D2 and C2. Diode D1 isolates the motor from the control circuit and D3 prevents the back EMF of the motor affecting the circuit. The bridge rectifier, D1 and the SCR should be mounted on a heatsink, as they dissipate quite a lot of heat. Stud mount types for D1 and the SCR simplify the wiring, as the connection between them is through the heatsink.

C. Beckham,
Shepparton, Vic. $45

Transformer protector

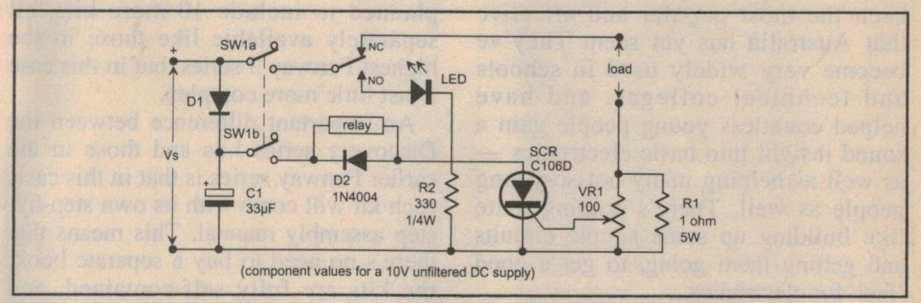
This circuit is designed to disconnect an overload from a transformer. Rectified voltage from the transformer secondary charges C1 through D1, and when SW1 is closed, current flows through the normally-closed contacts of the relay to the load.

This current also flows in the parallel combination of R1 and VR1, where VR1 is adjusted to operate the SCR when the desired maximum load current is exceeded. When the SCR is turned on, current from C1 and D1 energises the relay, thus removing the load from the transformer and connecting LED1 via R2 to the supply voltage. The only current now being drawn is through the relay coil and the LED.

When the overload has been removed, SW1 is turned off to allow the relay contacts to return to the normally-closed position. If the transformer primary has been turned off, SW1b also allows C1 to recharge, so the relay will operate again if the fault is a short circuit.

The circuit was devised for small slot cars and can be adapted for other uses, or to battery powered circuits. Diode D1 can be replaced by the LED. The values shown on the circuit work with a 10V (peak, no load) unfiltered supply from a 1A transformer like the DSE M-2155.

J. Nolan,
Maroochydore, Qld. $30



Temperature controller

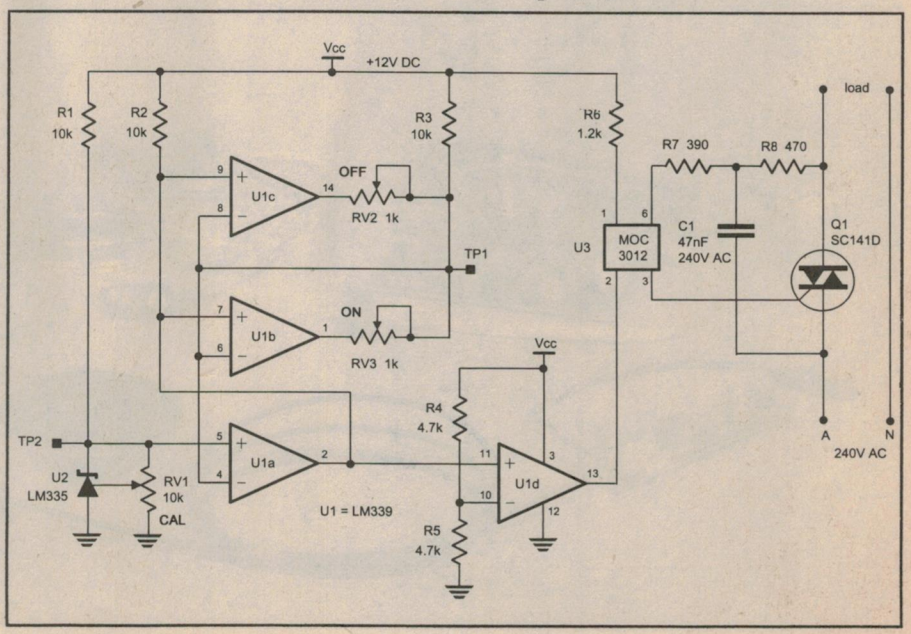
This is a design for a low cost temperature controller that has independent settings for the on and off temperatures. In my case I use it to control a 25W/240V AC light globe to keep my home brewer at the proper operating temperature. It can be used to control either a heating or cooling device. The following calibration procedure will also explain how the circuit works.

The temperature sensor is U2, an LM355, which is calibrated with RV1 so the voltage at TP2 is 10mV per degree centigrade. (That is, at 25°C, the voltage is 250mV.) Set both RV2 and RV3 to their maximum resistance and earth test point 2 (TP2), which should make the output of U1a (pin 2) go low. This will turn on comparator U1b and the output of U1c will go low. In this condition RV3 (the ON adjustment) will control the reference voltage to comparator U1a.

Set RV3 so the voltage at TP1 corresponds to the desired ON temperature, remembering that each 10mV is one degree centigrade. Now remove the earth from TP2 and heat the LM355 so its output goes above the voltage at TP1. Comparators U1b and c will change state and RV2 (the OFF adjustment) now provides the reference voltage to comparator U1a. It can now be set to the desired OFF setting.

Comparator U1d drives the triac via opto isolator U3. The load is switched by the triac. Alternatively, U1d could drive a relay, if you don't want triac switching.

Bob Hunter,
Margate, Qld. $45



Cover story:

NEW 'DISCOVERY SERIES' LEARNING PROJECTS FROM DSE

Dick Smith Electronics has decided to launch a new series of electronic learning kits, to build upon the foundations provided by its very popular 'Funway Into Electronics' families. The new kits are to be known as the Discovery Series, and are designed to provide newcomers to electronics with an opportunity to develop still further their 'hands on' experience and skills.

Without a doubt, the Dick Smith Electronics 'Funway Into Electronics' series of electronics learning kits has been the most popular and effective that Australia has yet seen. They've become very widely used in schools and technical colleges, and have helped countless young people gain a sound insight into basic electronics — as well as helping many not-so-young people as well. There's nothing quite like building up some simple circuits and getting them going, to get a good 'feel' for electronics...

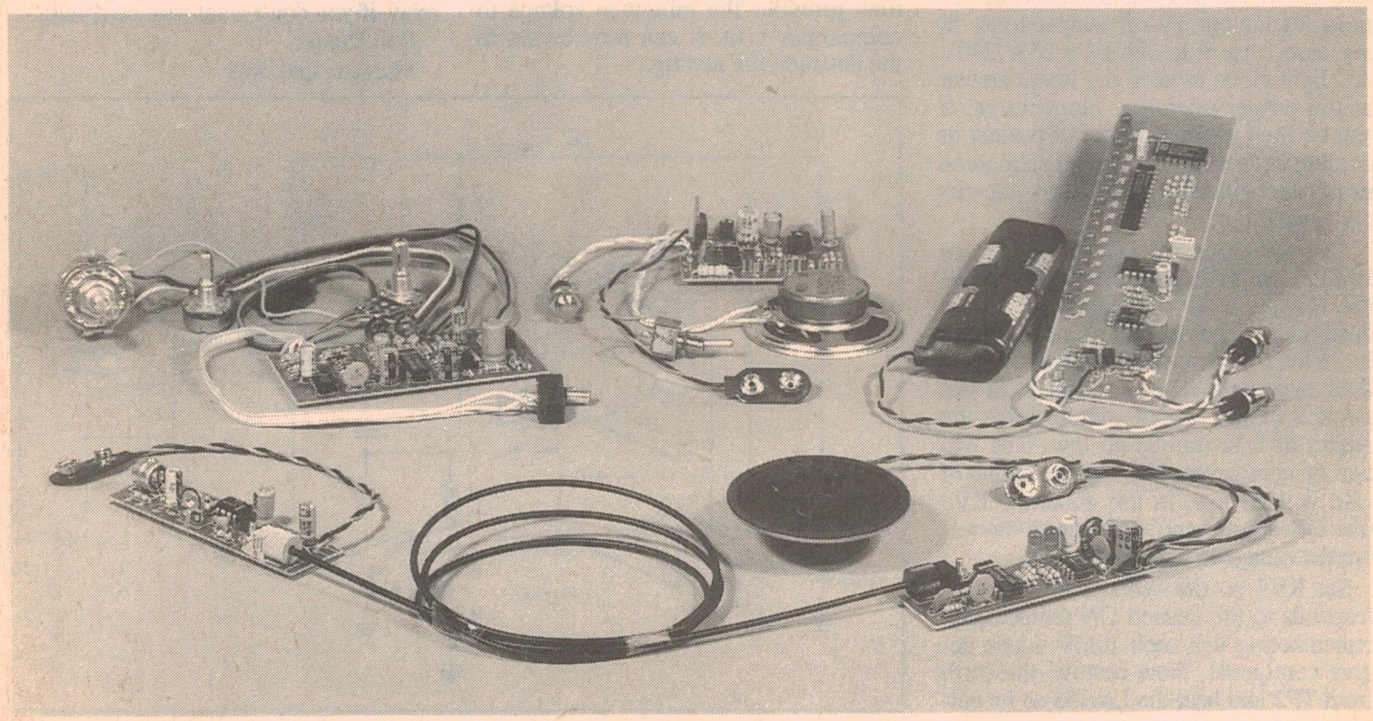
But DSE has never been a company to rest on its laurels, and now it has decided to launch a new Discovery series — designed to follow on from Funway and provide the newcomer with even further opportunities to enhance their skills. At present the new series is planned to include 10 more kits, all separately available like those in the highest Funway 3 series, but in this case a just little more complex.

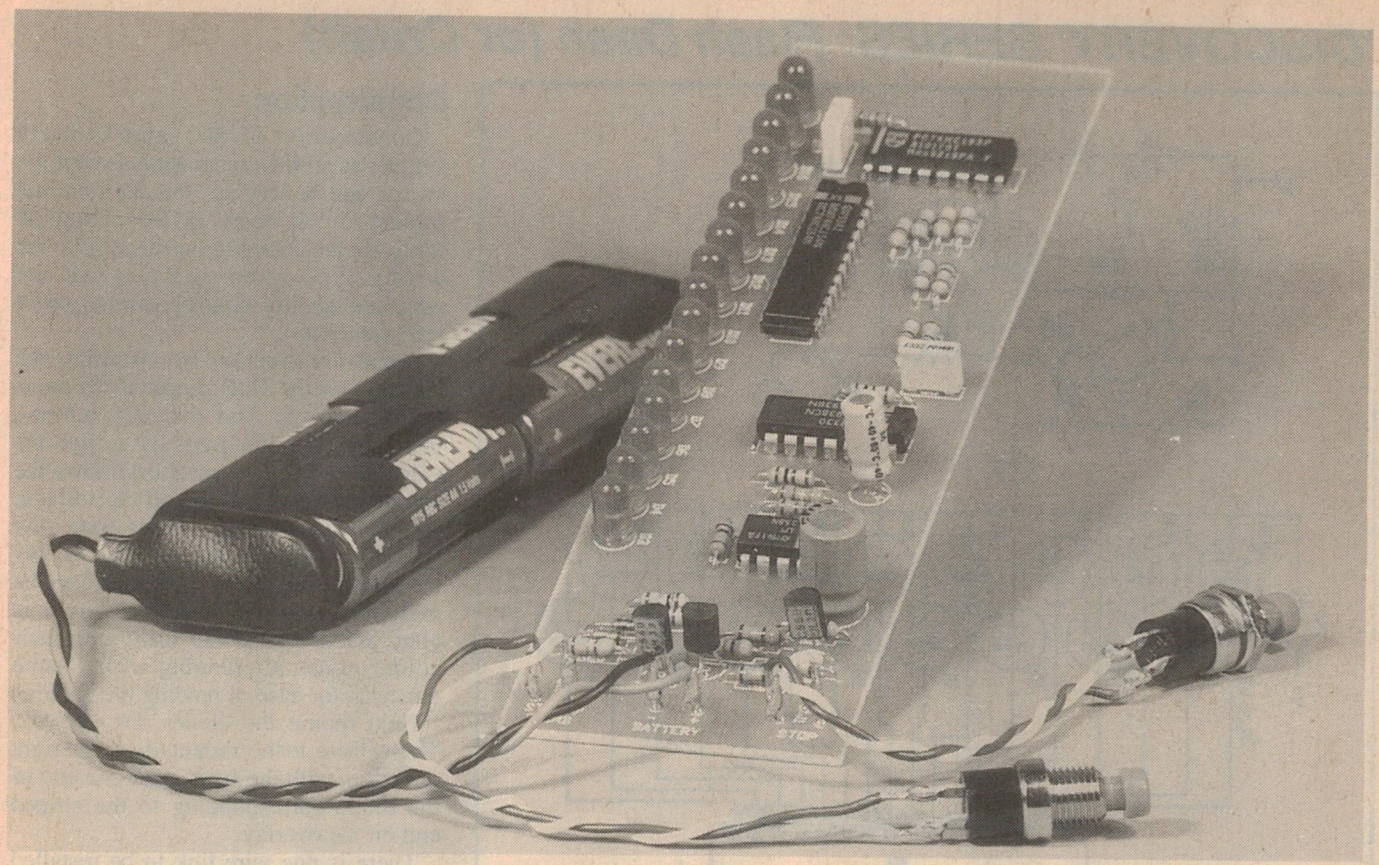
An important difference between the Discovery series kits and those in the earlier Funway series is that in this case, each kit will come with its own step-by-step assembly manual. This means that there's no need to buy a separate book; the kits are fully self-contained, and thus provide you with a friendly transition to standard electronic project kits.

The first four kits of the new Discovery series to be released are a 'LEDs and Ladders' type game called Flash Dash, a simple Electronic Siren, a Waveform Generator and Fibre Optic Communications Link. And over the next few months, by special arrangement with Dick Smith Electronics, we'll be presenting each of these projects in turn. This should give you a good idea of both the technical level at which the series is pitched, and the way they're being presented.

In each case, we'll be presenting what is essentially only a slightly modified version of the manual supplied by DSE with the kit concerned.

Let's begin, then, by looking at the first kit: an updated version of the old 'LEDs and Ladders' game...





FLASH DASH (OR CRASH)

The first of the new DSE Discovery kits, Flash Dash is a simple but effective game of skill which also demonstrates the application of a number of important concepts in digital electronics — including up/down counting, digital-to-analog and analog-to-digital conversion, and the operation of a 'window' comparator. Designated as Cat. No.K-2800, the kit is now available from Dick Smith stores for $19.95.

Flash Dash is a game that will test both your patience and your hand/eye coordination. It consists of a display made of 16 LEDs which operate in sequence — the LEDs representing stages on a slippery hill climb, the rungs of a ladder etc. The game is operated with just one control: a climb button, which controls movement up and down. Easy as climbing a ladder you say?, well just wait until you feel the muscle strain from this one!

Features of the kit include minimal wiring, low power consumption, automatic power cut-off, compatibility with NiCad batteries as well as non-rechargeable types, and for those interested in the technical aspects of the circuit, an analog to digital converter (ADC) which uses a digital to analog converter as part of its circuit.

The single printed circuit board used in this kit is designed to slide directly into a DSE Zippy box (Cat. No. H-2851), without the need for any board mounting components.

Operation

When the batteries are first connected, or when the circuit has not been in use for several minutes, all of the LEDs will be off. To start the game, the climb button is held on until the bottom LED begins to flash, which takes about six seconds.

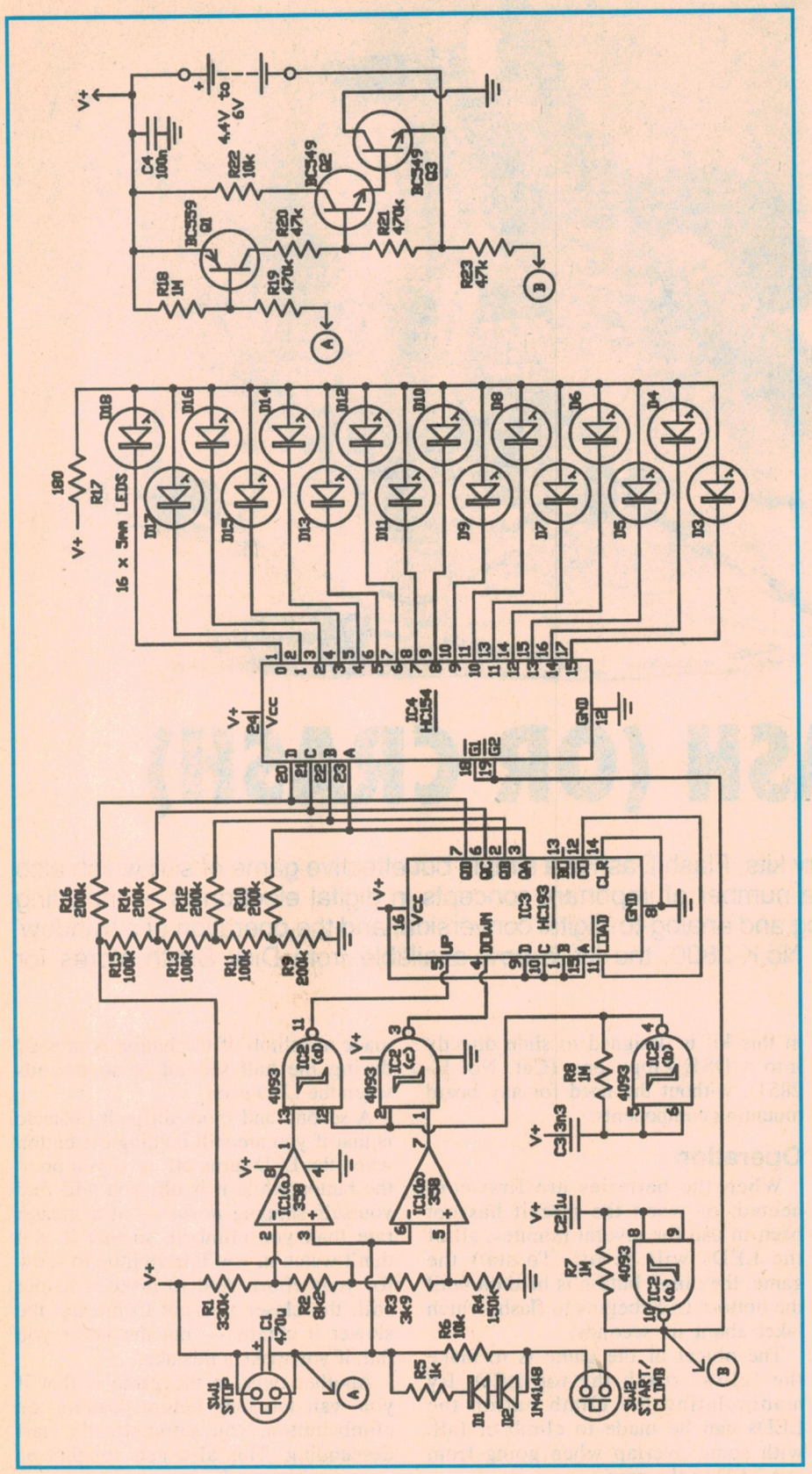
The object of the game is to make the 'glow' reach the top LED. By manipulating the climb button the LEDs can be made to climb or fall, with some overlap when going from one LED to the next.

The first obstacle to reaching the top is that the LEDs flash on and off at about once per second, and can only be made to 'climb' if the button is pressed during the half-second or so periods when the LED is on.

A second and more difficult obstacle is that if you are still holding the button when the LED turns off, or if you press the button while it is off, you will find yourself slipping *down* — at a greater rate than you climbed, so that if you don't watch it, you'll have little to show for your effort. And to make it harder still, the closer you get to the top the slower it climbs — but the faster you fall, if you make a mistake.

Another twist to the game is that if you wait too long before pushing the climb button, you automatically start descending. This also gets tougher as you get higher. In the event that you reach the top, and still have a little energy left, a bit of extra climbing effort will make all 16 LEDs flash.

'DISCOVERY' SERIES: Flash Dash (or Crash)



The circuit diagram for the Flash Dash (or Crash) game. Although only a few chips are involved, an ingenious configuration is used to produce what is in effect, a simple analog to digital converter and 'moving dot' LED display.

Construction

Construction of the game is fairly simple, as all the components except the switch and battery are mounted on one printed circuit board (PCB). If any of the parts are found to be missing or the wrong type, then you can use the enclosed quality control card to order replacements.

Begin construction by installing the resistors on the PCB. Look at the overlay diagram to find the part number, then look down the parts list to find the value required. The parts list shows the colour code that will be on the resistor. The last band of the colour code (the tolerance value) is the one that is furthest from the others. Resistors can be mounted in either direction, but it is good practice to mount them with their colour codes all running in the same direction for ease of reading the values.

Next mount the diodes, D1 and D2. These have to be mounted in the right direction, with the stripe near one end of the diode corresponding to the striped end on the overlay.

There is one wire link to be installed on the PCB. A piece of excess wire lead cut from one of the resistors can be used for this.

Next mount the two electrolytic capacitors, C1 and C2. Note that these are polarised and can be damaged if fitted the wrong way around. The outside of the capacitor case is normally marked with a stripe and a negative sign (-) on one side near one of the leads, the other lead being positive (+). The overlay shows where the positive lead goes.

Now mount the 'MKT' plastic capacitors C3 and C4. These can be mounted in either direction.

Next mount the transistors Q1, Q2 and Q3. Position them so that the flat side is as shown on the overlay. Note that Q1 is of a different type (BC559) to Q2 and Q3 (BC549) — don't confuse them as this could again cause damage. Also don't press them down hard onto the board, as this spreads the leads excessively and can damage the transistor's internal connections.

Next mount the integrated circuits IC1-4. **But take care: IC's 2-4 are CMOS types, which are sensitive to static electricity. Note the following precautions:**

- Do not remove them from their protective foam until you are ready to install them.
- Avoid touching the pins with your fingers.

- Make sure that your soldering iron is properly earthed.
- Solder the power and earth pins to the board first.

Note that each IC has a semicircular 'notch' at one end of the body. Fit each IC to the board with this notch at the end where the notch is shown on the overlay diagram.

The next parts to be installed are the 16 LEDs, D3-18. The cathode of each LED is the lead next to the flat plastic section of the case, and the location of these leads are identified on the PCB overlay diagram with a 'k'.

There is some choice about the mounting of the LEDs. They can be mounted on either side of the board, with the LEDs bent to face away from the board, so that the board slides into the grooves of the zippy box with the bodies of the LEDs going through holes drilled in the face of the box.

Alternatively, wires can be run from the board to the LEDs, to allow them to be mounted with a greater spacing. If you choose this latter approach, a sample template has been provided for drilling the face of the box in a zig-zag pattern.

Lastly, the battery snap connector and the Start/Climb button can be wired to the PCB. Note that there are two spare terminals provided, for an off (Stop) switch SW1. The same type of button as the climb button can be connected here, to turn the game off manually — although this can be left out, because the game turns off automatically if the climb button is not used for more than about five minutes. The life of the batteries is long enough that the five minute turn-off time should not be a problem.

With the assembly of the board complete, carefully check all the soldering. Look especially for dry joints where the components are soldered to the PCB, and solder bridges shorting tracks together. Your game should now be ready to test.

Testing it

CAUTION: Do not use a plug pack to power this kit unless it is a 6V regulated type, and do not use a battery with a voltage greater than 6V. Also be careful to connect the battery the right way around, because connecting the battery in reverse — even briefly — can damage the circuit.

Connect the battery and check that all the LEDs are off. If they are all off, then hold the climb button down and check that the bottom LED starts to flash after about six seconds, at a rate of about one flash per second.

To test the climbing, get a length of wire and temporarily connect the anode of D2 to the negative terminal of the battery and check that the LED glow climbs one at a time (with some overlap) from the bottom to the top in about 10 seconds, and then all 16 LEDs flash together. **Do not press the button while this wire is connected.**

Disconnect the wire and hold the climb button on and the glow should 'fall' from the top LED to the bottom in about two seconds. To check the automatic power cut-off, leave the button unpressed and the bottom LED should go off after about five minutes.

If any of the above tests do not work, then remove the battery and re-check the PCB for dry joints or solder bridges. Also check that the IC's, electrolytic capacitors, diodes and transistors are connected the right way around.

How it works

The component in this circuit which has the most critical functions is capacitor C1. The voltage across C1 determines the position of the LED on the ladder, and also operates the automatic power switch.

The automatic power switch is the section of the circuit at the right, using transistors Q1, Q2 and Q3. If the voltage across C1 is greater than about 0.6V, then Q1 and Q2 provide enough current to switch on Q3, which powers up the circuit.

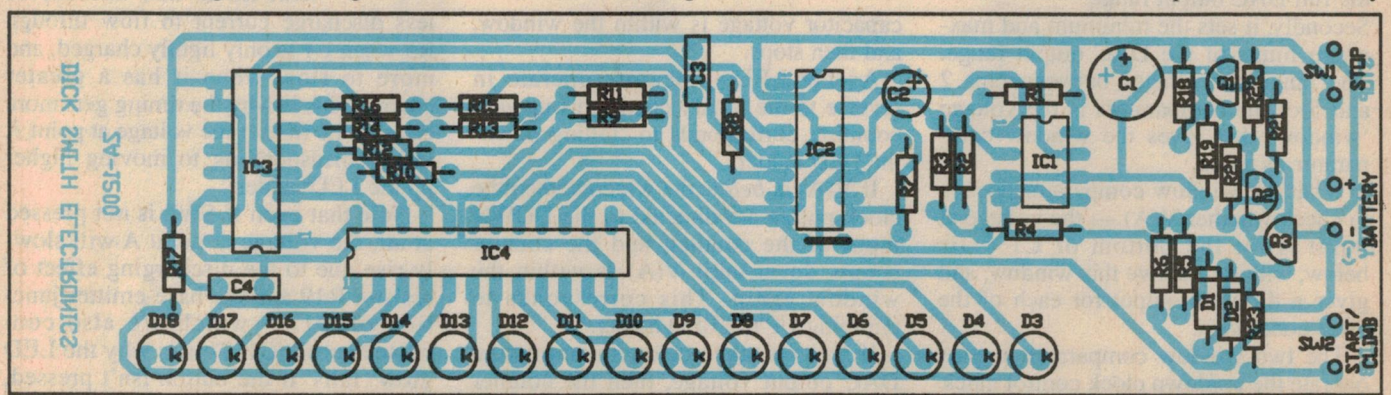
To charge C1 to a high enough voltage to turn the power on, R23 is provided as a path around Q3 to charge C1 via the climb pushbutton SW2 and R6.

As soon as the power comes on, a square wave appears at pin 10 of IC2a which alternately charges C1 (via R6) and discharges it (via R5, D1 and D2), causing the voltage across the capacitor to stay at about 1.4V. At this voltage level the first LED flashes.

The oscillator which makes the LEDs flash at about once per second uses NAND gate IC2a. Another oscillator of the same type is used to operate counter IC3, but this one (IC2b) oscillates at about 300Hz. These oscillators are of the 'relaxation' type, and their operation depends on the inverter (in this case a NAND gate with the inputs tied together) being a Schmitt trigger type — which has a large *hysteresis* (the difference between the input voltage needed to switch the output high, and that needed to switch it low), and also a full rail-to-rail output voltage swing.

With this type of oscillator the timing capacitors (C2, C3) are usually tied to ground rather than V+, but it is necessary here to have C2 connected this way around to get the correct initial duty cycle from the oscillator. If it were connected in the more usual way, C1 would be discharged as soon as power was applied, and the circuit would turn off straight away.

The next stage in the circuit is an analog to digital converter (ADC), involving a loop circuit made of the following sections — counter IC3, digital to analog converter (DAC) R9-16, a window comparator formed by



Here is the PCB overlay diagram for the game. As with any project of this type, it's important to fit the polarised components (the ICs, diodes, transistors, and electrolytic capacitors) the correct way around, to ensure correct operation. The switch marked SW1 is not strictly necessary, as explained in the text, as the circuit will turn itself off automatically.

IC1a and b, and clock control gates IC2c and d.

The digital output of this ADC is a four-bit binary number, appearing at the QA-QD outputs of counter IC3 — QA being the least significant digit (LSD) and QD the most significant digit (MSD). This binary number can have 16 possible values, each value being decoded by IC4 to operate one of the LEDs D3-18. But note that the operation of the LEDs is in reverse order to the binary value; i.e., the lowest LED on the ladder represents the binary value 1111 and the highest LED a value of 0000.

So the current binary count of IC3 determines which LED will be flashing, but in reverse binary fashion.

The operation of each section of the ADC is as follows. Starting at the output of the ADC, as well as going to decoder IC4 the binary value goes to a simple type of resistive network DAC commonly known as an 'R-2R ladder', composed of R9-16. The DAC converts the digital value to a proportional analog voltage, which is then applied via resistive divider R1-4 to two inputs of the window comparator formed by IC1a and b.

The resistive divider has two functions. Firstly, it creates a voltage difference between pins 2 and 5 of the comparators, which remains fixed over the full DAC output range. Secondly, it sets the minimum and maximum limits of the DAC output range. The range of voltages between pins 2 and 5 of the comparators is the voltage 'window' that gives the window comparator its name.

What the window comparator does is to check whether V(A) — the voltage at point A, at the bottom of C1 — is below, within or above this window, and gives a different output for each of the three conditions.

The two window comparator outputs operate the up/down clock control gates, IC2c and d. These NAND gates select whether the output of the clock (using IC2b) goes to either the up or down inputs of counter IC3, or whether they're both cut off. This depends on the window comparator outputs, as follows.

If V(A) is *within* the window, then both comparator outputs are at zero volts — causing the output of both gates to go high and holding the count at its current value.

If V(A) is *above* the window, then pin 7 of comparator IC1b goes low and pin 1 of IC1a goes high, sending clock pulses to the UP input of the counter. The counter then counts up until the capacitor voltage is within the window, and then stops.

As the LED indicators operate in reverse to the binary count, this upward counting corresponds to 'falling down' the LED ladder...

If V(A) is *below* the window, then the clock pulses are directed to the DOWN input of the counter, and the counter counts down until V(A) is within the window again. This corresponds to climbing UP the LED ladder...

If V(A) is taken below the minimum DAC output voltage, then the counter will still receive count down pulses, even though it is already at its lowest count (0000). This causes the counter to repetitively count down from 1111 to 0000. The LEDs follow the count and, because of the fast rate of the counter oscillator, they all appear to flash together.

Note that the actual LED flashing is produced by driving the G1-bar and G2-bar gating inputs of IC4 from the 1Hz squarewave output of oscillator IC2a.

The final key to understanding the way that the circuit operates is by considering how the 'Climb' button SW2 controls the charge voltage on capacitor C1.

Basically, SW2 does this by completing the circuit between C1 and the output of IC2a, via either R6 or the R5/D1/D2 series combination. And since the output of IC2a is switching alternately between +V and ground, at a 1Hz rate, this means that the effect of SW2 on C1's charge depends on exactly *when* it's pressed.

If it's pressed when the output of IC2a is *low* (corresponding to the current LED glowing), C1 will tend to be charged via R6, and its total charge voltage will increase. Hence the voltage at point A will move down.

On the other hand if SW2 is pressed when the output of IC2a is *high* (corresponding to the current LED not glowing), C1 will tend to be discharged, via not only R6 but also R5 (via D1 and D2). Hence the charge voltage on C1 will decrease, and the voltage at point A will rise.

By the way, the reason for using two diodes in series with R5 is that this causes less discharge current to flow through R5 when C1 is only lightly charged, and more to flow when it has a greater charge. This is why the timing gets more critical, the further the voltage at point A falls (corresponding to moving higher up the LED ladder).

Note that even if SW2 is not pressed at all, the voltage at point A will slowly rise due to the discharging effect of resistor R19 and the base-emitter junction of Q1 — which are also connected across C1. This is why the LED glow 'falls' if the button isn't pressed, and also why the circuit turns itself off automatically after five minutes or so. Neat, eh? ❖

PARTS LIST

Resistors

(All 0.25W 1% metal film unless otherwise stated)

	4-band code	5-band code
R1	330k Org-Org-Yel-Brn	Org-Org-Blk-Org-Brn
R2	8.2k Gry-Red-Red-Brn	Gry-Red-Blk-Brn-Brn
R3	3.9k Org-Wht-Red-Brn	Org-Wht-Blk-Brn-Brn
R4	150k Brn-Grn-Yel-Brn	Brn-Grn-Blk-Org-Brn
R5	1k Brn-Blk-Red-Brn	Brn-Blk-Blk-Brn-Brn
R6,22	10k Brn-Blk-Org-Brn	Brn-Blk-Blk-Red-Brn
R7,8,18	1M Brn-Blk-Grn-Brn	Brn-Blk-Blk-Yel-Brn
R9,10,12,14,16	200k Red-Blk-Yel-Brn	Red-Blk-Blk-Org-Brn
R11,13,15	100k Brn-Blk-Yel-Brn	Brn-Blk-Blk-Org-Brn
R17	180 Brn-Gry-Brn-Brn	Brn-Gry-Blk-Blk-Brn
R19,21	470k Yel-Vio-Yel-Brn	Yel-Vio-Blk-Org-Brn
R20,23	47k Yel-Vio-Org-Brn	Yel-Vio-Blk-Red-Brn

Capacitors

C1	470uF 10VW RB electrolytic
C2	1uF 50VW RB electrolytic
C3	3.3nF 100V MKT polyester (3n3/332)
C4	0.1uF 100V MKT polyester (100n/104)

Semiconductors

D1,2	1N4148 or 1N914 signal diode
D3-18	5mm round red LED
Q1	BC559 PNP small signal transistor
Q2,3	BC549 NPN small signal transistor
IC1	LM358 dual op-amp
IC2	4093 quad 2-input NAND Schmitt CMOS
IC3	74HC193 4-bit up/down counter CMOS
IC4	74HC154 4-to-16 decoder CMOS

Miscellaneous

PCB, 150 x 43mm, code ZA-1200; momentary pushbutton switch; 4 x AA battery holder; battery snap connector; solder, hookup wire etc.

Digital Domino

Continued from page 23

processing can be done. Image file size is 36MB/frame.

The Domino Bench operator works in real time, viewing a giant 16:9 screen, and can run the action at a full 24fps (cinema speed) accessing all the tricks of the other Quantel devices. Currently there are six Domino installations worldwide: in the UK, the USA and Hong Kong. Is Australia next?

Other answers

Quantel's technology is an amalgam of unique software and hardware, purpose-created to solve production tasks. In the stratospheric zones of broadcast quality the price of necessary equipment has been secondary — until recent years, when economic stringency and galloping technology forced many producers and broadcasters to rethink.

A 'basic' Paintbox can be bought for £23,500. A Henry costs between £420,000 - 510,000, depending on storage. Should you need a full Domino installation, be prepared to pay £2 million. Advances in technology and an explosion in creative demands have meant many operators in video/film have looked elsewhere. It's hard to ignore movie sophistication such as used in *Jurassic Park* and *Terminator II*. The amazing image trickery in these two films alone could not have been done without serried rows of Silicon Graphics workstations.

As we run through 1994, the Macintosh computer systems are also knocking at the door of high end video processing.

Industry criticism of Quantel's products mostly falls upon their closed architecture approach, preventing even the use of fresh and specialised software and hardware for 'one off' production creations. Quantel say they are not in this market. As MD Jeff Meadows says, "...the Quantel workstations are not computers. They consist of purpose-built hardware combined with the ultimate in user-friendly software."

Dave Scammell, VP Engineering, sees the field occupied by the Domino digital film optical system as "much broader than that of CGI (Computer Graphic Imaging) design". In his view, "Every project is different. For *Terminator II* you need metal men, for *Jurassic Park* you need Serapods. A single, dedicated system like Domino begins to look very attractive."

One can only hope Steven Spielberg agrees! ❖

STOP PRESS:

FLUKE RELEASES 'SECOND GENERATION' SCOPEMETER

Just as we were going to press, we were advised by local test instrument distributor Obiat that Fluke has released a new series of 'second generation' models, in its popular ScopeMeter range of portable hand-held testing tools.

Like the original models, the new Series II ScopeMeters combine a dual-channel 50MHz digital storage scope with a 3-2/3 digit true-RMS multimeter, in a rugged and battery powered handheld unit. However the new models add functions which are claimed to be 'never before offered in a handheld test tool', including a 'Measure Menu' which automatically configures the instrument for any of 30 measurement tasks. Another addition, known as Continuous Autoset, eliminates the front-panel configuring that other instruments require as the user moves from one test point to another.

Other features of the new instruments include simultaneous display of signal waveform and measurement values, and a backlit LCD display on all models.

Electronics Australia hopes to be able to present a review of one of the new ScopeMeter Series II models in the very near future...

R&D OVERLOAD?

To meet your urgent design and development requirements we provide a range of Engineering services including:

- PCB layout
- PC based application software
- Embedded controller software
- Prototype design & construction

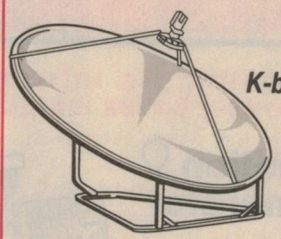
TEL: (03) 828 2827
FAX: (03) 431 1888

Diamond Valley Engineering Consultants

READER INFO NO. 15

YOU CAN NOW AFFORD YOUR OWN SATELLITE TV SYSTEM

For many years you have probably looked at satellite TV systems and thought "one day".



Your own K-band system from only:

$995

HERE'S WHAT YOU GET:

- Prime focus or offset dish configured for your location.
- Super low noise LNB/feedhorn.
- 25m low loss coaxial cable.
- DYNALINK 50 channel stereo satellite receiver, with remote control. Pre-programmed to Optus frequencies.
- Pointing co-ordinates for your location.

Ask about our regular newsletters and Customer BBS. Send coupon for your free info pack, listing all items and prices.



CALL FOR YOUR NEAREST RE-SELLER

Direct Importer: AV-COMM PTY. LTD.
PO Box 225, Balgowlah NSW 2093
Tel: (02) 949 7417 Fax: (02) 949 7095

YES GARRY, please send me more information on K-band satellite systems.

Name: _____

Address: _____

_____ P'code: _____

Phone: _____

ACN 002 174 478

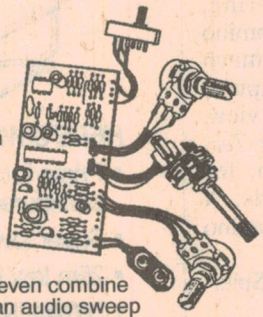
READER INFO NO. 16

DICK SMITH ELECTRONICS

Our New DISCOVERY SERIES Makes Electronics Even More Exciting!

The ultimate introduction to the fascinating world of electronics, our new Discovery Series includes a range of practical kits that are both fun and easy to build.

Function Generator Kit

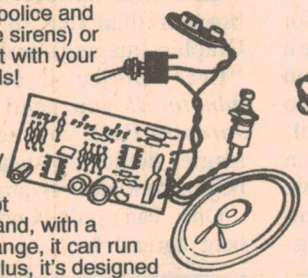


The affordable and fun way to build a very useful and highly versatile function generator! Both amplitude and frequency are voltage controlled so you can even combine two of these to make an audio sweep generator or amplitude modulated audio generator! Its voltage regulator ensures good stability against varying supply voltage and loading while a trimming facility is provided for frequency alignment when a calibrated dial is used. Can be powered from a single 9V battery (not supplied) or any DC supply between 8.5V and 15V. Comes in shortform with all components, PCB & hardware such as pots & switches.

Cat K-2802

NEW **$16.95**

Siren Generator

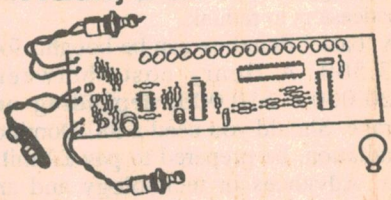


Create four different siren sounds (including police and ambulance sirens) or experiment with your own sounds! The siren generator runs on either a 6V or 9V battery (not supplied) and, with a simple change, it can run on 12V. Plus, it's designed to fit a Dick Smith Electronics zippy box (optional) so you can achieve a professional-looking finish. Fun and easy to build, it comes complete with all components, PCB & hardware such as switches, battery-snap & speaker.

Cat K-2801

NEW **$16.95**

Flash, Dash Or Crash!



Construct your very own exciting game of patience, co-ordination and skill. Featuring 16 LEDs which operate in sequence, the game requires you to 'climb' the ladder of LEDs by pushing a button. Sound easy? Well, wait until you try it! It has automatic power cut-off, low power consumption and takes both NiCad and alkaline batteries.
The kit is easy to build, requiring minimal wiring.

Cat K-2800

NEW **$19.95**

More New Kits To Build!

Clifford - The Electronic Cricket



NEW

Experience the feel of the 'great outdoors' without leaving your living room! Turn off your lights and you'll see the cricket's eyes (LEDs) glow and hear it omit a sound that closely resembles the 'chirp' of a cricket. Turn the lights back on and it will stop. Its compact size (40 x 35mm) makes it easy to hide so you'll have hours of fun fooling your family and friends! Simple to build, it's supplied in short form with all components, PCB, battery-snap and piezo alarm.

Cat K-3533

SILICON CHIP Dec '94

$11.95

Car Alarm With battery back-Up



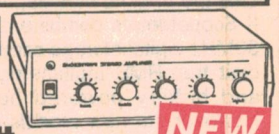
NEW

This affordable kit places a quality feature-packed car alarm well within your reach. Based on the Philips OM1681C car alarm IC, it's relatively straightforward to build yet it provides similar features to those found in expensive commercially available units. Such features include battery back up, presettable entry and exit delay periods, delayed and immediate trigger inputs, voltage drop sensing, flashing status LED, automatic resetting after 60 seconds and the ability to automatically operate a central door locking system with optional interface controller (K-4314) & UHF remote switch (K-3260) to be releases in Jan '95. Comes complete with all components, PCB, hardware including automotive multiway connector, case & siren with back-up battery.

Cat K-4312

SILICON CHIP Dec '94

$89.95



NEW

15 Watt Stereo Amplifier

Impressive stereo sound at a great low price! A simplified version of commercially-available amplifiers, this 15W amp is both easy-to-build and very affordable. Ideal for hooking up to your hi-fi system, it features Bass, Treble, Balance and Volume controls plus an input selector that lets you choose between three line-level input signals - CD, tuner and TV. The kit includes all items to build the project in full form, from components right through to hardware including case & pre-punched screened front panel.

Cat K-5610

EA Dec '94

$119.95

See Us First For All Of Your Electronic Needs!

Fibre Optic Receiving Coupler



To suit the transmitter (Z-2750). Provides highly-sensitive photo-darlington output, is easy to mount and comes complete with connectors for quick and easy termination and connection.

Cat Z-4752

NEW **$6.95**

Fibre Optic Transmitting Coupler

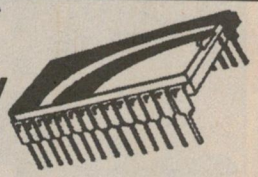
Ideal for any application requiring short distance communications, medical electronics, microprocessor systems or for experimenting in the exciting new field of fibre optic communications. It offers a fast LED response time (up to 10MHz) and is housed in a low-cost plastic casing, allowing for easy board mounting. Includes connectors for fast and simple termination and connection.

Cat Z-4750

NEW **$9.95**

OM 1681C

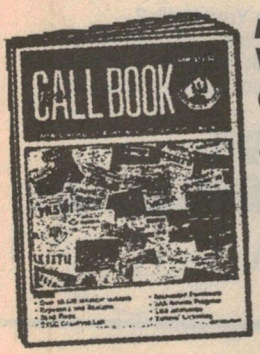
Car Security Alarm Hybrid I.C



A complete car alarm in one chip, requiring only minimal external components. It performs as a glass breakage amplifier & detector with protection against false triggering and RF interference. You can adjust both exit and entry delays and four pins are provided for a continuous alarm output, flashing alarm output, alarm status indicator and a low power output which is activated when the alarm is armed.

Cat Z-6190

$24.95



Limited Stocks!

WIA Amateur Radio Call Book

Don't miss out on your copy of the 1995 edition! Contains complete, up to the minute listings with valuable information about all listed members. Covers call signs, suffixes, shortwave, Department of Transport & Communications information and more.

Cat B-2337

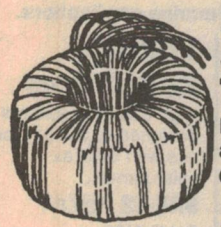
NEW **$12.50**

Assorted Hook-Up Wire Packs

Handy packs of hook-up wire.
They come in assorted colours and three different lengths:
5m x 10 x 0.25mm
7m x 7 x 0.20mm
4m x 24 x 0.20mm

NEW

Cat W-4011 **$1.95**



28-0-28V 300VA Transformer

Ideal for a range of amplifier projects.

Cat M-1610

$79.95

NEW

10mm Car Alarm LED

A Deterrent To Thieves!



An ideal replacement for your existing light or can be wired to the ignition to fool thieves. It's easy to install and has reverse polarity protection.

Cat L-5323

$12.95

NEW

Also Available: 5mm diameter version **$9.95**

Cat L-5322

Save $10

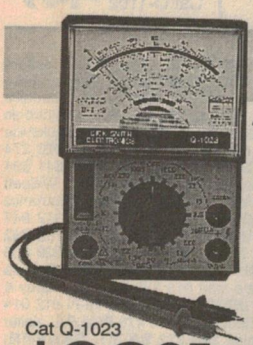
Mini Strobe Light



Bright flashing light that can be mounted outside, making it instantly obvious where the alarm is coming from when the system is triggered. Suits most alarm systems and runs on 12V DC. Blue 70mm Diam.

Cat L-6002

$24.95



Save $10

19 Ranges Plus dB

A compact and reliable multimeter with continuity testing plus mirrored scale. It offers great features at a low price including high sensitivity (20,000 ohms per volt) and recessed terminals for added safety.

Ranges:

DCV:	2.5, 10, 50, 250, 1000V
ACV:	10, 50, 250, 1000V
DC (Current):	5mA, 50mA, 500mA & 20A
Resistance:	x 1, x 10, x 1K
Battery test:	1.5V & 9V
dB:	-8 dB to +22 dB

Cat Q-1023

$29.95



3.5 Digit Multimeter

This accurate 19-range meter measures AC/DC voltages, DC current and resistance, plus it's incredibly compact and easy to use! Has a diode test function, 10 Amp (DC) current range and a transistor test socket. All in a durable, safety yellow casing.

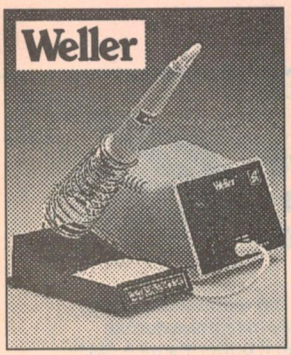
Ranges:

DCV:	0.2V, 2V, 20V, 200V, 1000V
ACV:	200, 750V
DC Current:	200uA, 2000uA, 20mA, 200mA, 10A
Resistance:	200, 2K, 20K, 200K, 2M

$39.95

Cat Q-1425

Don't Miss Our Great Low Prices!



Bonus Side Cutters!

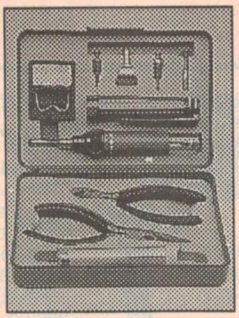
WTCPS Quality Solder Station

Its non-burning silicon rubber power cable and long-life, iron-plated tip make this Weller so 48 watts capacity, low voltage internal transformer, lightweight soldering pencil and special "closed-loop" temperature control. Complete with stand and cleaning sponge.

Cat T-3000

$179

BONUS
Side Cutters (T-2999)
valued at $29.95



Pro's Kit Soldering System

The Soldering Kit You Can Afford!

Includes quality butane iron, non-slip stand, solder, side cutters and pliers. With torch tip, 2.4mm soldering tip, hot knife tip and handy carry case. (Gas not included).

Cat T-1200 **$59.95**

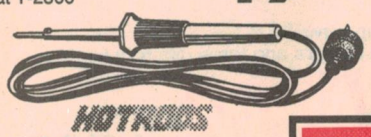
Excellent Value!

Quality Soldering Iron - Bargain Priced!

An extremely efficient 25W soldering iron with 240V operation, 370°C operating temperature and long-life replaceable tips.

$19.95

Cat T-2300



Complete With Case!

16-Piece Computer Servicing Kit

Save money, service your computer yourself! This kit includes PLCC extractor and IC inserter, pliers, hex drivers, torx bits, screwdrivers, and a Pearl Catch, all in an attractive zippered case.

Cat T-4843

$49.95



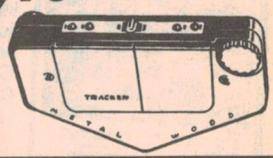
Save $10

Tracker Stud Finder

What's Inside Your Walls? Ideal for locating joists, battens and rafters through walls and for detecting live/dead cables, pipes and mains.

Cat T-1990

$29.95



New Low Prices On Solarex!

SOLAR PANELS

Suitable for a huge range of applications including communications, pumping and irrigation, remote homes and marine applications.

	Cat.No	Peak Watts	Current (Nom. Voltage)	Volts (Open Circuit)	Amp Hrs/Wk	Watts Hrs/Wk	Size	Warranty	Price
SA-5	O-1005	5 Watts	0.33A	23V	13.86	194.04	306 x 346 x 21 mm	10 years	**$115**
MSX-10	O-1011	10 Watts	0.59A	21V	24.78	346.92	420 x 269 x 23 mm	10 years	**$159**
MSX-18S	O-1020	18.5 Watts	1.13A	21V	47.46	664.44	418 x 498 x 23 mm	10 years	**$249**
MSX-40	O-1040	40 Watts	2.51A	21.1V	105.4	1475.9	764 x 502 x 54mm	20 years	**$369**
MSX-64	O-1064	64 Watts	4.0A	21.3V	168	2352	1109 x 502 x 50mm	20 years	**$499**
***MSX-83**	O-1083	83 Watts	5.3A	21.2V	221	3094	1109 x 660 x 50mm	20 years	**$699**

*Available (on special order). Specifications all at 25°C.

Voltage Regulators

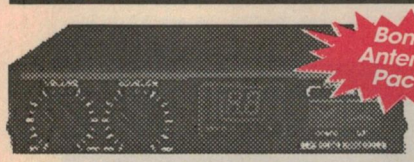
High quality regulators designed especially for use with Solarex solar panels.

SR8-12 12V 8A
Cat O-1100 **$74.95**

***SR18-12**
12V 18A
Cat O-1102 **$149**

MAJOR DICK SMITH ELECTRONICS AUTHORISED STOCKISTS:
NSW ARMIDALE: New England Electronics 711 655 **BALLINA:** Ballina Electronics 867 022 **BATEMAN'S BAY:** Baycity Sight & Sound 725 030 **BATHURST:** Electronic Frontiers 323 933 **BOURKE:** Countrywide Services 722 150 **BOWRAL:** Bowral Electrical Suppliers 611 861 **BROKEN HILL:** Hobbies & Electronics 884 098 **COOTAMUNDRA:** Cootamundra Music & Light 422 561 **DENILIQUIN:** Deni Electronics 813 672 **DUBBO:** Chris's Hi Fi 828 711 **GOULBURN:** Tunlive 221 288 **GRAFTON:** Repairs & Spares 421 911 **GRIFFITH:** Miatronics 624 534 **GUNNEDAH:** Carter's Sportscene & Electronics 42 2230 **INVERELL:** Infolink Computer Systems 22 1821 **KEMPSEY:** P & K Richards 631 134 **LEETON:** Leeton Audiotronic 532 800 **LIGHTNING RIDGE:** Lightning Ridge Solar Power 291 013 **LISMORE:** Decro Electronic Services 214 137 **LITHGOW:** Douroy Photographics 513 173 **MACKSVILLE:** Macksville Electronics 683 368 **MOREE:** Moree Electronics 522 091 **MUDGEE:** Headwear 723 895 **MURWILLUMBAH:** Strings & Things 723 684 **NARRABRI:** Namoi Computer Service 923 274 **NELSON BAY:** Nelson Bay Elect. & Hobbies 813 685 **NOWRA:** Nowra Electronics 210 722 **PARKES:** Strad Music Centre 623 366 **PORT MACQUARIE:** Port Electronics 841 594 **RICHMOND:** Silicon Crafts 784 101 **TAREE:** Manning Electronics 512 233 **TUNCURRY:** Tuncurry Electronics 545 006 **WAGGA WAGGA:** Phillips Electronics 216 558 **WALGETT:** Walgett Electronic Centre 281 111 **WINDSOR:** Hawkesbury Electronics 776 722 **YASS:** Warmington Electrical 226 1411 **YOUNG:** Keith Donges 821 279 **VIC ARARAT:** Jerram Electronics 522 345 **BAIRNSDALE:** Green Gage Services 525 677 **BENALLA:** North East Electronics 622 710 **CASTLEMAINE:** Inspect Electrics 723 773 **COLAC:** Colac Electronics 312 847 **ECHUCA:** Gilmour Electronics 822 956 **HORSHAM:** Burgess Camera House 824 680 LEONGATHA: Leongatha Photographics 623 227 **MILDURA:** Pullman Auto Pro 232 882 **MORWELL:** Roylaine Pty Ltd 339 458 **ROSEBUD:** Seatech Vic Pty Ltd 822 225 **SHEPPARTON:** Andrew Guyatt Electronics 219 497 **SWAN HILL:** Nyah District TV Service 329 303 **ST. ARNAUD:** Whartons Appliances 951 069 **WARRAGUL:** Roylaine 234 255 **WARRNAMBOOL:** Koroit St. Elect. Services 627 417 **WONTHAGGI:** South Gippsland Photo Service 721 411 **QLD AYR:** Delta Electrix 831 566 **BOWEN:** Plaza Electronics 863 477 **BUNDABERG:** Bob Elkin Electronics 521 785 **CALOUNDRA:** Electro-mart 918 533 **DALBY:** Hobby & Electronics 625 770 **GOONDIWINDI:** CTW Electronics 713 411 **GYMPIE:** Cooloola Electronics Pty Ltd 83 6677 **INGHAM:** Masons Electronics 763 188 **INNISFAIL:** Innisfail Hi-Fi 612 014 **MACKAY:** Steven's Electronics 511 723 **MARYBOROUGH:** Keller Electronics 214 559 **MOSSMAN:** Mossman Electronics 982 200 **MT. ISA:** Outback Electronics 433 475 **PIALBA:** Keller Electronics 283 749 **STANTHORPE:** Granite Belt Communications 813 333 **TAS BURNIE:** Electronic City 314 760 **DEVONPORT:** Al Electronics 248 322 **SA MT. GAMBIER:** Hutchesson's Communication 250 400 **PORT LINCOLN:** Basshams TV & Comp. World 830 075 **WHYALLA:** Eyre Electronics 454 764 **WA ALBANY:** Micro Electronics 412 077 **BUNBURY:** Micro Electronics 216 222 **GERALDTON:** Angora Lighting 211 278 **MANDURAH:** Mandurah Hi Fi 581 2206 **MARGARET RIVER:** CPA Electronics 573 888 **PORT HEDLAND:** Ivan Tomek Electronics - Retail 732 531

We Are Australia's Radio Specialists!

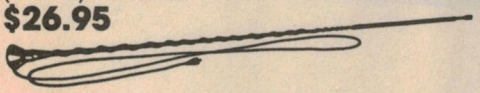


Slimline AM CB Radio

At just 140 x 30 x 130mm, it doesn't take up much room in the dashboard, while its combination of touch-control channel selection and bright LED display allows for easy operation. Features: Built-in noise limiter, external speaker socket and all 40 AM channels. With mic. & mounting kit.

Bonus Antenna Pack (D-4076) valued at **$26.95**

Cat D-1200 **$89.95**



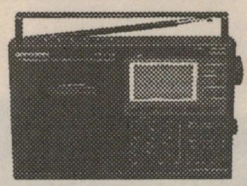


60XLT Scanner

New, simple-to-use 10-channel scanning receiver for listening to known VHF/UHF services. Covers 66-88,137-174, and 406-512MHz. Also great for listening to ethnic language services that don't operate on the FM broadcast band.

Cat D-2746 **NEW**

uniden. **$169.95**



All-Band World Receiver

SANGEAN

With Cassette Player

Enter the fascinating world of shortwave radio with this quality digital-tuned Sangean ATS-818CS. It provides continuous 1.62 to 30MHz Shortwave coverage, plus local AM/FM and longwave bands. The inbuilt cassette lets you record the station you're listening to or play your favourite tape. It's incredibly easy to operate, with 45 station memories, pushbutton scanning, direct keypad station entry or two-speed rotary tuning. Its large back-lit digital display shows exactly what's happening, while an adjustable RF gain control ensures optimum reception, even under differing reception conditions! Plus, its dual-time clock with sleep function lets you wake to music or alarm.

Cat D-2842 **$369**

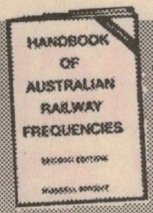


Reduced!

Dick Smith Electronics Australian Frequency Handbook

This edition has information on using your scanner, as well as understanding codes & marine bands. Plus, there's a glossary of scanner terms, frequency directory and more!

Cat B-9601 **$9.95**



2nd Edition

Australian Railway Frequencies Handbook

Gives a complete listing of Australian Railways (and New Zealand Railways) radio frequencies, glossary of railway terms, track and guage data, locomotive rosters and system maps.

Cat B-4118 **$19.95**



Radio Receivers Registers

A complete listing of state-wide radio frequencies. You'll find fascinating frequencies to listen in on including: Ambulance, Police, State Emergency Services, Aviation and hundreds of commercial frequencies. Includes an expanded repeater list.

NSW	Cat B-4140	**$24.95**	QLD	Cat B-4146	**$24.95**
VIC	Cat B-4142	**$24.95**	SA/NT	Cat B-4148	**$24.95**
WA	Cat B-4144	**$24.95**	TAS	Cat B-4150	**$19.95**



Register of Govt. Radio Frequencies NSW/ACT/Vic - 2nd Edition

An up-dated frequency list of govt. services in NSW, ACT and Victoria. Includes frequency allocations and radio codes for Police, Fire Brigades, State Emergency Centres and more.

Cat B-4130 **$24.95**



Home & Holiday Scanner Frequency Guide

This comprehensive guide contains complete listings of Scanner frequencies state-wide. The perfect travel companion, it even includes Highway Route charts and listings for country and small town areas. With the 'Home & Holiday Frequency Guide', you can listen in on such services as ambulance, fire and police wherever you are!

NSW Cat B-4400
Victoria Cat B-4402 **$39.95ea**

PHONE, FAX & MAILORDER SERVICE

Outside Sydney (FREE Call) 008 22 6610
Sydney and Enquiries - (02) 888 2105

Fax: (02) 805 1986 or write to Dick Smith Electronics, Mail Orders, Reply Paid 160 PO Box 321 NORTH RYDE NSW 2113
All major Credit Cards accepted. Overnight Courier Available.

B 1827

DICK SMITH ELECTRONICS

NSW • Albury **21 8399** • Bankstown Square **707 4888** • Blacktown **671 7722** • Bondi **387 1444** • Brookvale **905 0441** • Burwood **744 7299** • Campbelltown **27 2199** • Chatswood Chase **411 1955** • Chullora **642 8922** • Gore Hill **439 5311** • Gosford **25 0235** • Hornsby **477 6633** • Hurstville **580 8622** • Kotara **56 2092** • Liverpool **600 9888** • Maitland **33 7866** • Mid City Centre **221 0000** • Miranda **525 2722** • Newcastle **61 1896** • North Ryde **878 3855** • North Sydney (Greenwood Plaza) **964 9467** • Orange **618 400** • Parramatta **689 2188** • Penrith **32 3400** • Railway Square **211 3777** • Sydney City **267 9111** • Tamworth **66 1711** • Wollongong **28 3800 ACT** • Belconnen **(06) 253 1785** • Fyshwick **280 4944 VIC** • Ballarat **31 5433** • Bendigo **43 0388** • Box Hill **890 0699** • Coburg **383 4455** • Dandenong **794 9377** • East Brighton **592 2366** • Essendon **379 7444** • Frankston **783 9144** • Geelong **232 711** • Highpoint **318 6300** • Melbourne City 399 Elizabeth St **326 6088** & 246 Bourke St **639 0396** • Richmond **428 1614** • Ringwood **879 5338** • Springvale **547 0522 QLD** • Alderley **356 3733** • Booval **282 6200** • Brisbane City **229 9377** • Buranda **391 6233** • Cairns **311 515** • Capalaba **245 2870** • Chermside **359 6255** • Maroochydore **791 800** • Mermaid Beach **785 600** • Rockhampton **27 9644** • Southport **32 9033** • Toowoomba **38 4300** • Townsville **72 5722** • Underwood **341 0844 SA** • Adelaide City **232 1200** • Elizabeth **255 6099** • Enfield **260 6088**• St Marys **277 8977** • Westlakes **235 1244 WA** • Balcatta **240 1911** • Cannington **451 8666** • Fremantle **335 9733** • Perth City **481 3261** • Midland **250 1460** • Northbridge **328 6944 TAS** • Glenorchy **732 176** • Hobart **31 0800** • Launceston **344 555 NT** • Darwin **811 977** *** STORES IN RED ARE OPEN SUNDAYS.STORES ACROSS AUSTRALIA AND NEW ZEALAND**

Construction project:



A BUDGET PRICED 'SHOESTRING' STEREO AMP

With a power rating of around 15 watts per channel and impressive noise and distortion performance, this new low cost amplifier is ideal for small hifi systems, 'home theatre' installations, and a host of other applications. It uses readily available parts, offers a basic range of features, and is very easy to put together.

by ROB EVANS

Considering that most domestic listening is done at a power level of only a few watts, it's interesting to note just how few low powered and keenly-priced stereo amplifiers are available in hifi stores — or for that matter, described in electronics magazines such as *Electronics Australia*.

While this could form the basis of an extended, and possibly heated debate, we would guess that the situation is largely due to two distinct factors: a common obsession with amplifier power, and the fact that nowadays, watts are relatively cheap. Or in practical terms, since an amplifier's *hardware* (case, controls, etc) plays a major role in setting the overall price, it doesn't cost *that* much more to put a 50W amp into a case, rather than a 10W amp...

Sidestepping the thorny area of power obsession for the moment, it seems that if the hardware costs of a small amplifier could be kept to an absolute minimum (scaled down to suit), we would then have a low-powered amp that represents undoubted value for money. And as a result, the unit would be suitable for a very wide range of applications — leaving the costly high-powered amps to the jobs where their expense can be justified.

The logical place to start when rationalising the amp's hardware is at the case itself, as this represents a large part of the hardware cost. As we really don't need a large impressive-looking black anodised metal case for this type of amp, we've elected to use one of the low-cost plastic instrument cases to house the circuitry of our new design — this has a rather plain, but nonetheless functional appearance, which nicely suits the job at hand.

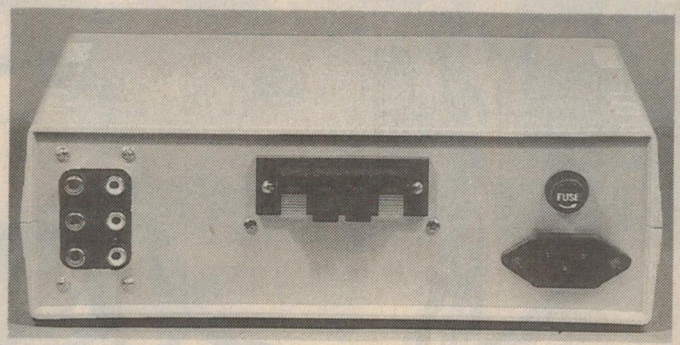
Since we can also do without raft of elaborate front panel controls (tone bypass, multiple tape loops and so on) which would be rarely used in this type of amp, we've gone for a basic layout of Bass, Treble, Balance and Volume controls; with an input selector switch to choose between just three line-level input signals — CD, tuner and TV. There are also considerable savings to be had here, as the cost of pots, switches and knobs adds up quite quickly indeed — and besides, you can only fit so many knobs on the front panel of even the 'large' plastic instrument case, as used in the amp.

Beyond the main hardware items, we've also taken a serious look at what was the most effective balance between the amp's power output capability, and the cost of the power supply and heatsinking required — both power transformers and heatsinks take a substantial share of the parts cost, as you would expect.

SPECIFICATIONS

Power output	One channel driven:	15W RMS into 8 ohms
		20W RMS into 4 ohms
	Both channels driven:	13W RMS into 8 ohms
		15W RMS into 4 ohms
Bridged mode:		29W RMS into 8 ohms
Distortion		THD: 0.05% at 14W RMS into 8 ohms
IMD:		0.03% at 14W RMS into 8 ohms
Bandwidth		10Hz to 100kHz (-3dB points)
Signal to Noise ratio		Approx 86dB with respect to 15W RMS (approx 80dB with pots unearthed)

By choosing the low-cost LM1875 '20W' audio amplifier IC from National Semiconductor for our power amp stage, we found that with a supply based on a common 6672-type power transformer the final amp produced a power output of around 15W per channel, and needed only modest (read: low-cost) heatsinking. In fact, thanks to the relatively low power output and well-regulated supply rails, we could use an aluminium rear panel on the box as a heatsink for the LM1875 chips. Note that to extract the full power capability from the LM1875, the required heatsink costs as much as the power amp chip itself...



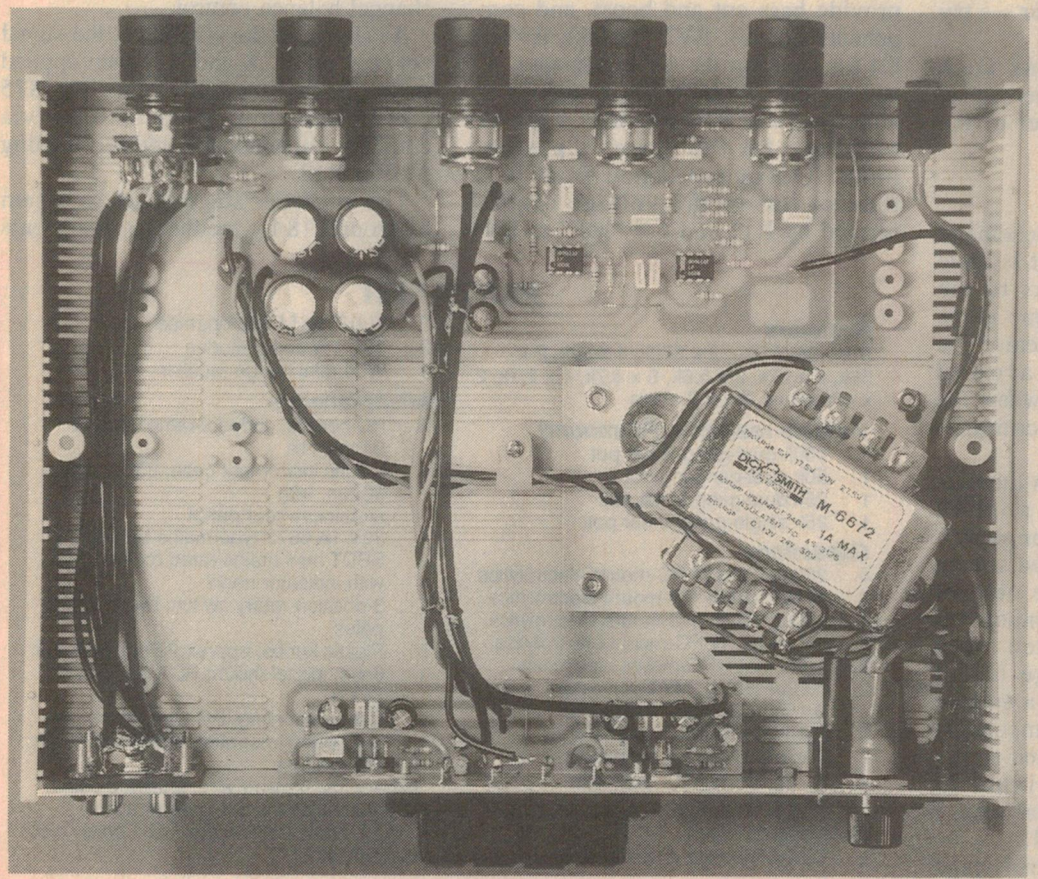
As well as acting as a heatsink for the LM1875 power amp ICs, the amp's aluminium rear panel also holds the input, output, and mains connectors.

As one thing tends to lead to another in this type of design rationalisation, we found that because the main supply rails are at less than 25V (+/-21V, in fact) with the 6672 transformer, low cost 25V-rated capacitors could be used though the circuit — again, this represented a noteworthy cost saving.

So all in all, the considered and moderate approach to the design has certainly paid dividends in this case, and has allowed us to extract the best possible value from common parts to produce the Shoestring Stereo Amplifier.

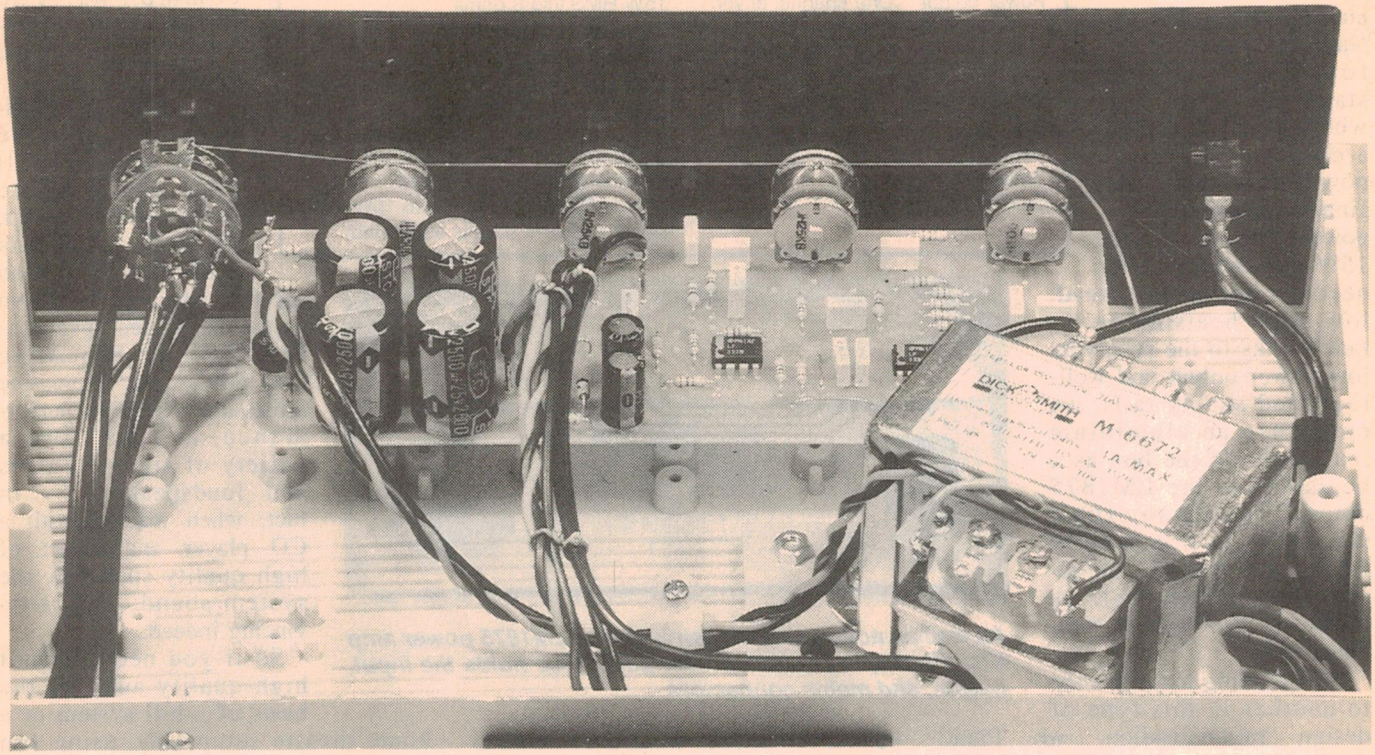
However, don't assume that because we've taken a hard-nosed look at the costing of the amp, the performance has suffered. As you can see from the figures shown in the associated specifications box, the Shoestring amp offers quite impressive noise and distortion performance, and will suit a variety of signal sources and loudspeakers — in fact, when teamed with a CD player and a set of high quality speakers, the system sounds very convincing indeed.

So if you need a small high-quality amp for the basis of a hifi system or a home theatre setup (say, using Jim Rowe's new 'Stereo TV Sound Receiver', coming next month) and you are operating on a shoestring budget, our new Shoestring Amplifier should be just the shot.



The amp has a very simple construction, and uses two small circuit boards; one for the preamp and power supply sections, and the other for the power amp stage.

Budget priced 'Shoestring' Stereo Amp



The main PCB is supported by the front panel via the four control pots. Note the earthing wire strung between the pot (and switch) bodies — this provides additional shielding against mains hum.

And by the way, don't underestimate just how much volume can be delivered by a 15W amplifier — try it for yourself; it's a lot...

Finally, we'd like to thank Dick Smith Electronics for their generous assistance in sourcing a number of the vital parts for this project.

Circuit description

As you can see from the schematic diagram the amplifier's circuit is quite straightforward, and thanks to the LM1875 integrated power amp chips uses surprisingly few components. The preamp stage is based around TL072/LM353 dual op-amps, where the tone control stage uses a common Baxandall feedback network.

In more detail, signals from the CD, Tuner and TV inputs are applied directly to the input selector switch SW1, which passes the desired source signal to the amp's volume control (RV1) via low-pass filter components R1 and C1. RV1's wiper then feeds the following buffer stage based around IC1a, which is set to a gain of around three by feedback components R4 and R3, and is AC coupled to the input by C2. R2 ties the input to ground (0V), while maintaining a high impedance load for RV1.

The subsequent tone control stage formed around IC2a uses network components R5, RV3 (Bass), R6 and C5 to provide bass cut and boost, and components C3, R8, RV2 (Treble), R9 and C4 for tailoring the treble response. R7 isolates the two networks to reduce interaction, and R10 provides a ground reference for the opamp's positive input. The output signal from IC2a then passes to the voltage divider formed by R11 and one 'half' of RV4 (Balance), which combine to act as a simple — but nevertheless effective — channel balance control.

As shown in the schematic, the signal between points X and Y is then applied to the positive input of the LM1875 power amp chip (pin 1 of IC3), via coupling capacitor C6 and terminating resistor R12.

The amplifier stage is set to a gain of around 18 by feedback components

PARTS LIST

Resistors
(All 0.25W 5%): 2 x 270k, 4 x 82k, 2 x 56k, 6 x 27k, 2 x 5.6k, 6 x 4.7k, 4 x 2.7k, 2 x 470 ohms, 2 x 2.7 ohms

Variable resistors (PC-mount)
1 100k dual-gang linear pot
1 50k dual-gang log pot
1 25k dual-gang linear pot
1 25k single-gang linear pot

Capacitors
4 2200uF 25VW PC-mount electrolytics
2 470uF 16VW PC-mount electrolytics
4 100uF 25VW PC-mount electrolytics
2 4.7uF 16VW PC-mount electrolytics
2 1uF bipolar PC-mount electroltics
2 0.22uF 63VW MKT polyester
2 0.15uF 63VW MKT polyester
6 0.1uF 63VW MKT polyester
2 10nF 63VW MKT polyester
4 4.7nF 63VW MKT polyester
2 470pF ceramic

Semiconductors
2 LM1875 power amplifier ICs
2 TL072 or LF353 opamps
2 12V 1W zener diodes
1 W04 mini bridge rectifier

Miscellaneous
2 PC boards, coded 94amp11a and 94amp11b
1 Plastic instrument case, 250 x 190 x 80mm, with aluminium rear panel
1 30V/1A 6672-type mains transformer
1 SPDT mini mains-rated rocker switch, with indicator neon
1 3-position rotary switch; two or more poles
5 Plastic knobs; approx 22mm diameter
1 6-way panel-mount RCA socket strip (2 x 3)
1 Panel-mounting IEC-type mains plug
1 3AG panel-mounting fuse holder, with 500mA fuse

Solder lugs, hookup wire, sheilded cable, PCB pins, aluminium plate (for transformer), heatshrink tubing, nuts, bolts, lockwashers, etc.

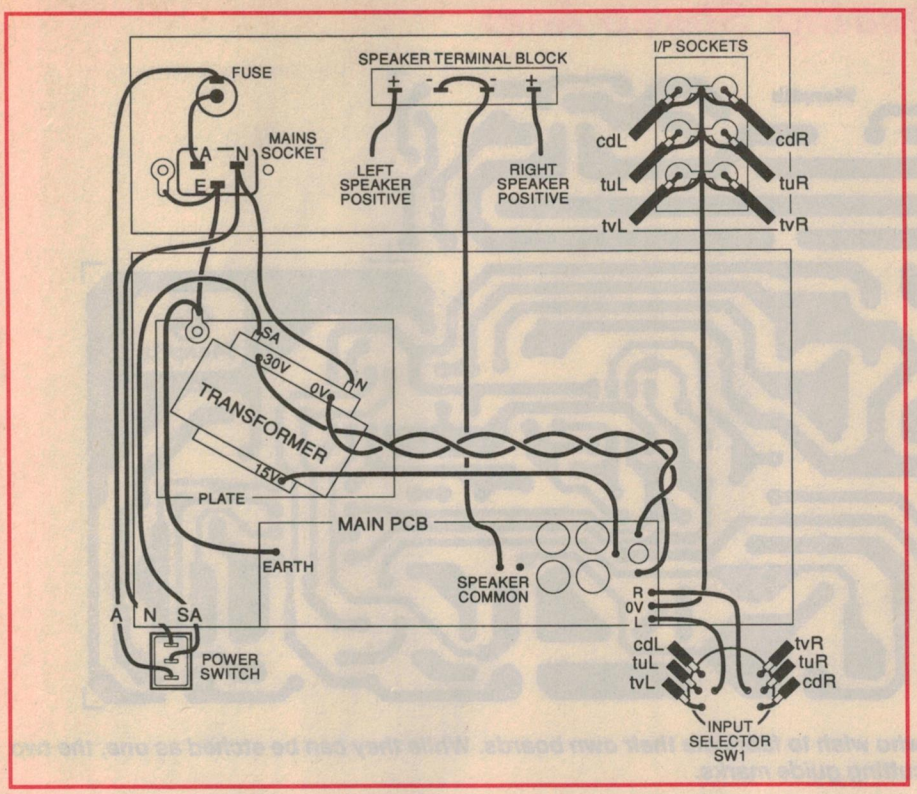


Fig.1: Use this diagram when completing the amp's internal wiring. Take particular care with the mains cabling, and make sure all exposed connections are well covered.

R14 and R13, which are AC coupled to ground by C7. Other than that, R15 and C8 offer a load to the IC's output at high frequencies (to enhance HF stability), and its supply rails are heavily bypassed by capacitors C9 to C12.

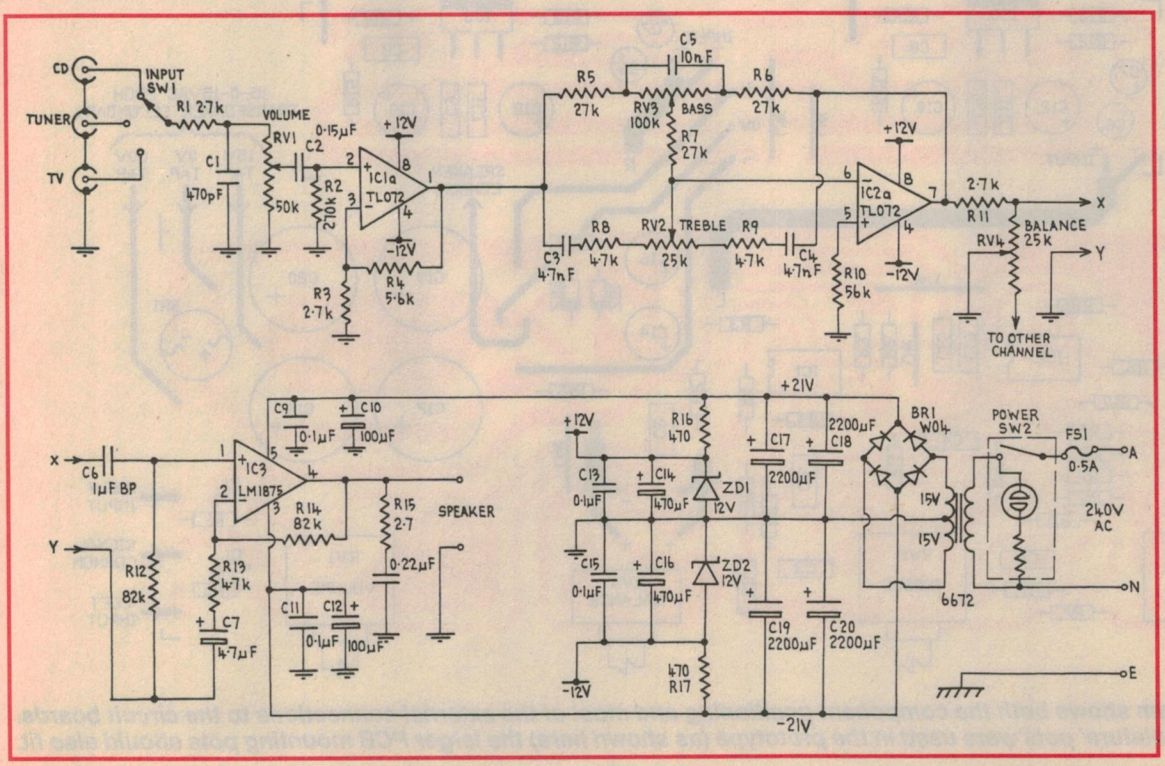
The remaining parts of the circuit form the unit's power supply, which provides +/-21V rails for IC3 and +/-12V supply rails for the preamp stages (IC1 and IC2). Note that while the schematic only shows the circuitry for *one* amplifier channel (IC1 to IC3), the common power supply stage provides power for both the left and right channels.

240V AC mains power is applied to the primary of the 6672-type transformer via fuse FS1 and power switch SW2, while the (nominally) 15-0-15V secondary winding drives bridge rectifier BR1. The resulting +/-21V rails are filtered by 2200uF reservoir capacitors C17 to C20, and in turn supply 12V zener diodes ZD1 and ZD2 via dropping resistors R16 and R17. Finally, the 12V supply rails are bypassed by capacitors C13 to C16.

Construction

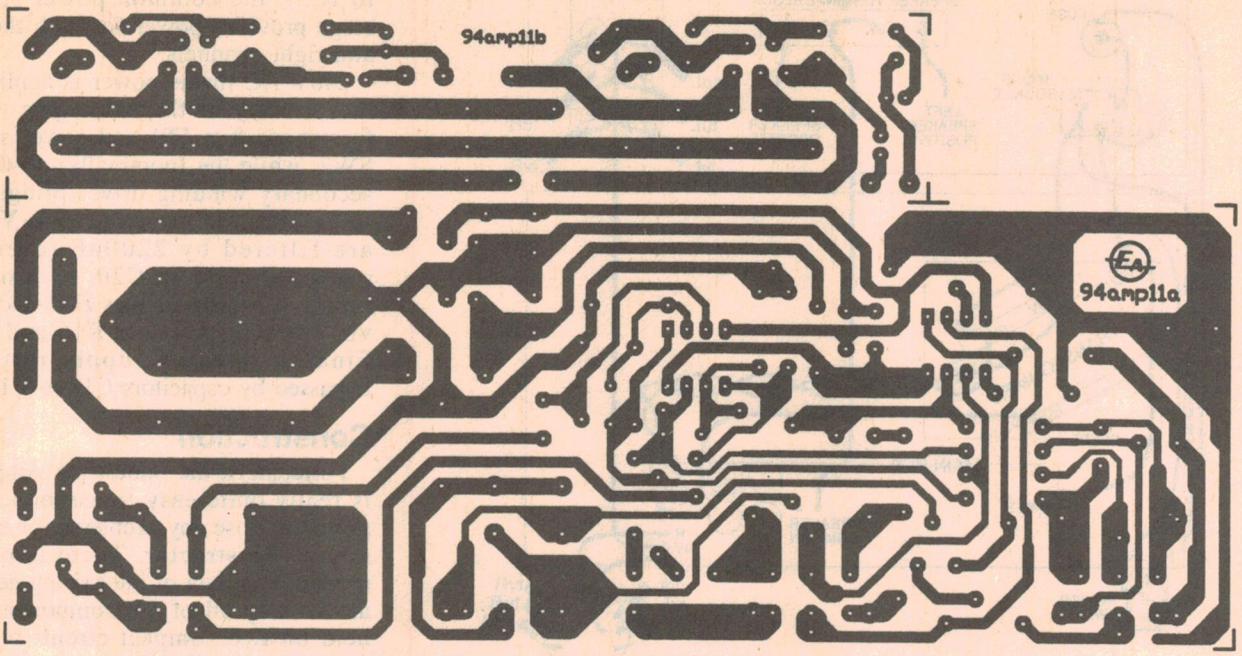
Fortunately, the Shoestring Amplifier is really quite easy to assemble, and shouldn't pose any problems for even a novice constructor. There is only a moderate amount of interwiring needed, as virtually all of the components are held on two compact circuit boards. These in turn mount directly onto the box panels without the need for supports or standoffs — provided PCB-mounting potentiometers are used.

If you elect to use the more traditional pots with solder lug connections in the amp, these can be wired to the front PCB using short lengths of hookup wire, during the later stages of the construction. Since the PCB is then not supported by the pots however, the board will need to be mounted into the bottom of the case using suitable



The amp's circuit couldn't be simpler. IC1a acts as an input buffer/amplifier, the tone control section is based around IC2a, and IC3 forms the power amp stage.

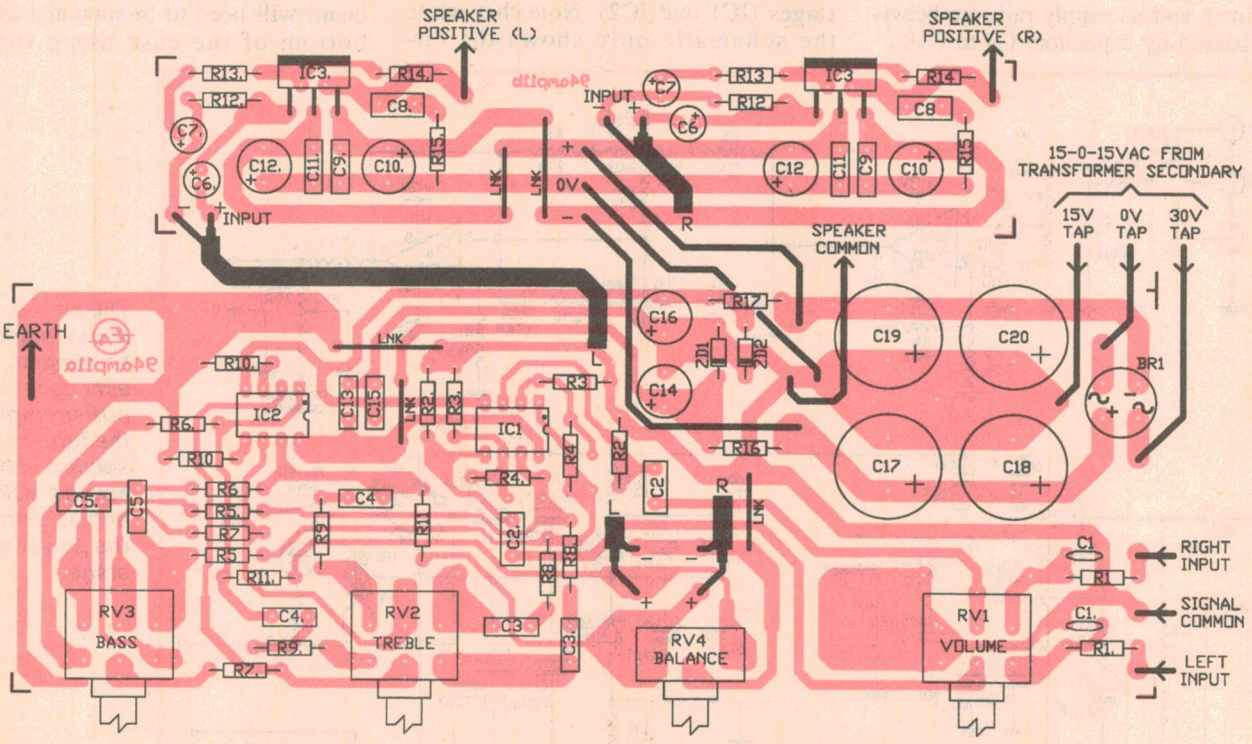
Budget priced 'Shoestring' Stereo Amp



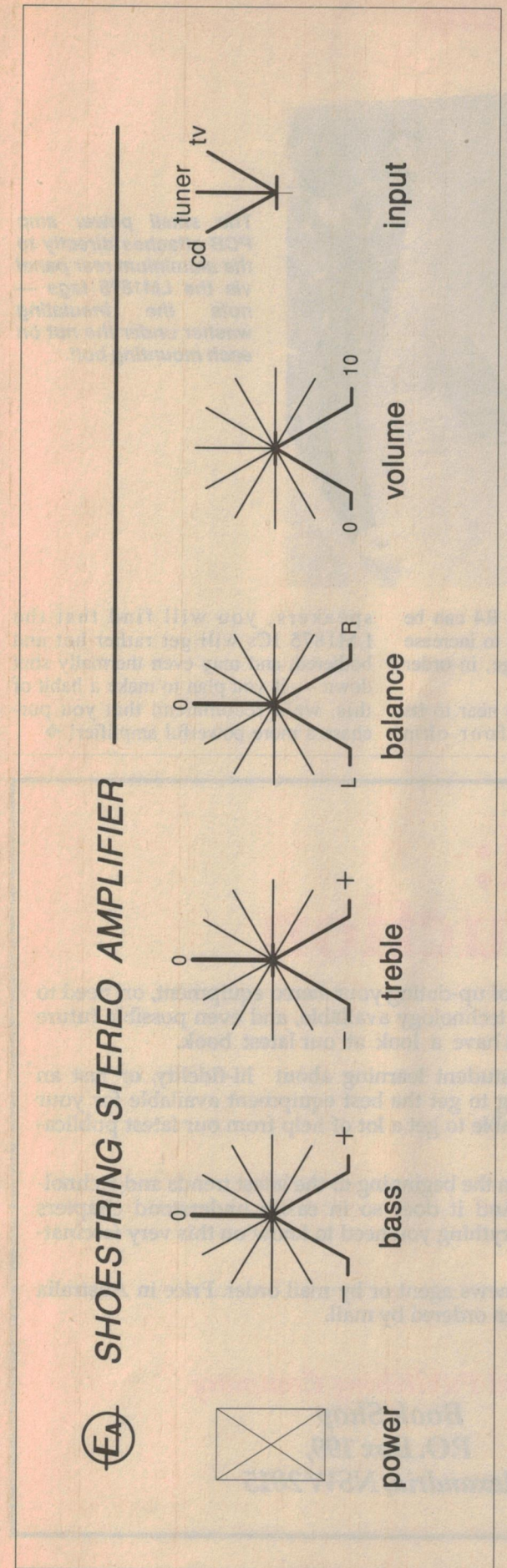
The actual sized PCB artwork for those who wish to fabricate their own boards. While they can be etched as one, the two boards will need to be separated at the cutting guide marks.

mounting screws. We really would recommend using PC-mounting pots though, as this simplifies the construction process by a significant degree.

Begin the construction by installing all of the lower-profile components (wire links, resistors and op-amps) into the PCBs as shown in the component overlay diagram. Note that the larger of the two boards (measuring 163mm x 59mm, and coded 94amp11a) contains the preamp and power supply sections and has three wire links, while the smaller board for the power amp stages (measuring 122mm x 25mm, and coded 94amp11b) has two links. As usual, take particular care with the orientation of the polarised components (electrolytic capacitors and semiconductors), and refer to the component overlay at all times.



This overlay diagram shows both the component positioning and most of the external connections to the circuit boards. Note that while 'miniature' pots were used in the prototype (as shown here) the larger PCB mounting pots should also fit.



And finally, the artwork for the front panel for those able to manufacture their own.

Note that in our prototype amp we've used PCB pins for all external connections, and have mounted resistors R16 and R17 in a slightly elevated position to assist cooling. Also, you may notice from the shots of the unit that we

have used a dual-ganged pot for the Balance control, rather that the specified single-ganged unit. This is simply because we had a dual unit of the correct value at hand when constructing the prototype, and we just removed the connecting pins of the outer unused pot. You can also see that we've earthed the bodies of the front panel controls with a length of copper wire, which ultimately connects to the 'earth' pin on the main PCB.

We found that this arrangement made the amp less susceptible to induced mains hum, since as you would expect, the case's plastic front panel does not offer any electrical shielding to the controls and their associated circuitry. When connecting the earth wire to the pots and the switch by the way, first score the surface with a small file, as this will help the soldering process. Once you are happy with the construction of the two circuit board assemblies, the main board can be fitted to the front panel via the pot shafts, and the power amp board bolted to the aluminium rear panel via the LM1875 mounting flanges. In the latter case, the power amp ICs should be fitted to the panel with a suitable mounting kit — namely, via an insulating mica washer (with thermal grease applied to both sides), and an isolating bush for the bolt. When this is completed, use a multimeter to check that both of the IC tabs are electrically isolated from the rear panel.

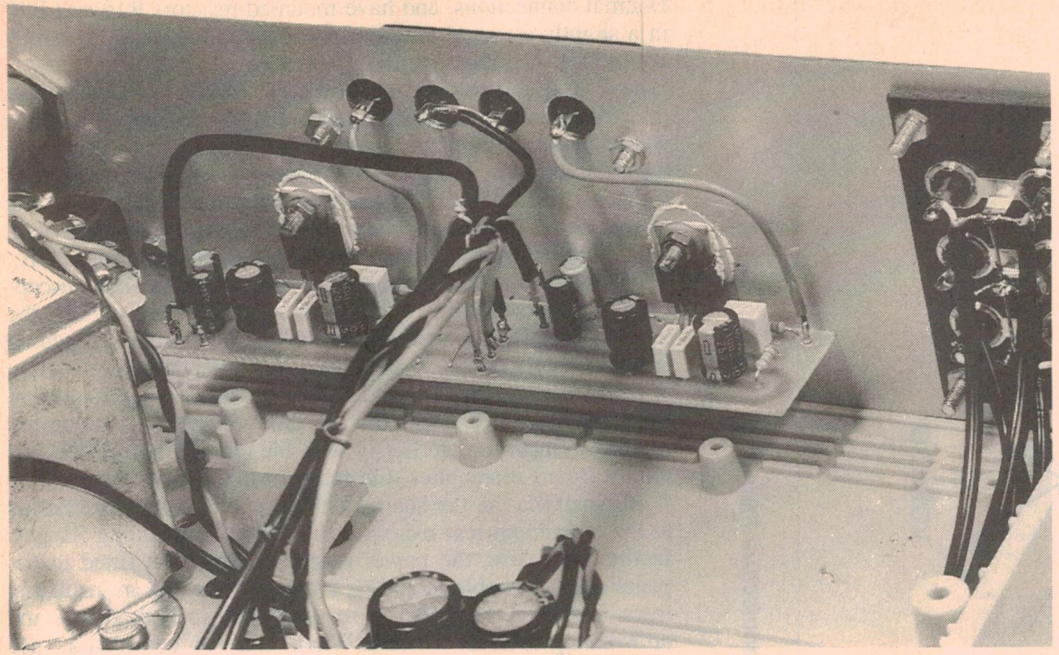
The remaining parts can now be installed in the case, and the interwiring completed as shown in both the component overlay and Fig.1. Notice that we have mounted the transformer on a section of (earthed) aluminium plate, and installed it at an angle of about 30° in our prototype, as this was found to be the position which induced the least mains hum into the preamp circuitry.

Carefully complete the 240V mains wiring as detailed in the schematic and Fig.1, while covering any exposed mains connection points with heatshrink or cambric sleeving. Note that the power switch terminals marked N (neutral) and SA (switched active) in Fig.1 can be identified on the actual switch by noting where two fine wires emerge from its body, as these are the connections for the internal neon indicator lamp. Therefore, the switch's N connection will be the outermost terminal which has a fine wire attached — the internal wiring of the switch is shown in the schematic, by the way.

Once you are satisfied that the mains wiring is correct, secure and well covered, all other wiring should really be completed before power is applied. This is particularly important for the power amp stage, since while its 0V *power* line connects at one point on the main PCB (near C19), its 0V *reference* (point Y on the schematic) is established via the shield of the input signal cable — in short, *both* 0V connections are needed for the amp to function correctly.

When wiring the lengths of shielded cable between the input sockets and the selector switch, note that the ground connections are all made at the *input socket* end, on the rear panel. This arrangement avoids the need to connect the shields at the switch end where the pin connections are rather crowded, while the ground path (0V) is completed by a length of hookup wire connected between the sockets and the PCB — see Fig.1.

That's about it for the construction of the Shoestring Amplifier. As there are no preliminary adjustments needed to setup the amp, the final step is to apply power and check the voltage levels at a couple of key points. First check that the speaker positive terminals measure close to 0V, then verify that the +/-21V and +/-12V rails are as specified (a small error here is no real cause for concern).



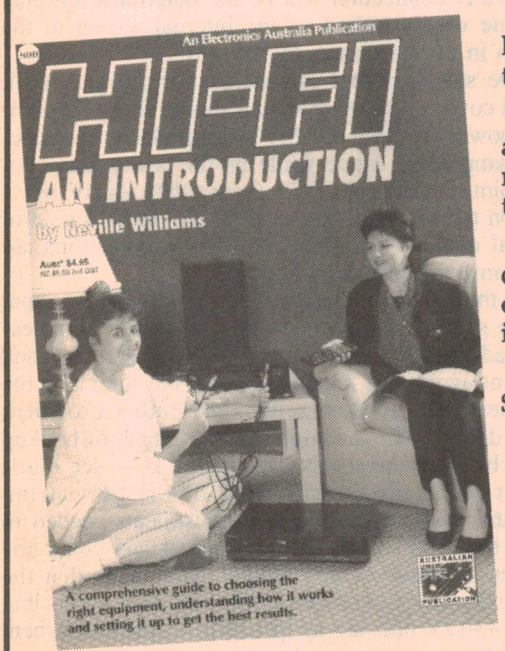
The small power amp PCB attaches directly to the aluminium rear panel via the LM1875 tags — note the insulating washer under the nut on each mounting bolt.

You're now ready to connect a set of speakers and a suitable signal source, then sit back and enjoy the fruits of your labour.

If you feel that the amp's overall gain is a little low or you have an unusually weak signal source, R4 can be raised in value (to say, 6.8k) to increase the gain of the preamp stage, in order to compensate.

Also, if you run the amp near to its maximum power into four ohm speakers, you will find that the LM1875 ICs will get rather hot and bothered, and may even thermally shut down — if you plan to make a habit of this, we'd recommend that you purchase a more powerful amplifier! ❖

HI-FI: An Introduction



If you are thinking of up-dating your stereo equipment, or need to know about the latest technology available, and even possible future trends, then you should have a look at our latest book.

Whether you are a student learning about hi-fidelity, or just an average person wanting to get the best equipment available for your money, you should be able to get a lot of help from our latest publication.

It takes you right from the beginning to the latest trends and technology available today. And it does so in easily understood chapters covering just about everything you need to know on this very fascinating subject.

Available from your news agent or by mail order. Price in Australia $4.95, plus $2 p&p, when ordered by mail.

Federal Publishing Company
Book Shop
P.O. Box 199,
Alexandria, NSW 2015

TECS — THE ELECTRONIC & COMPUTER SUPPLIERS

MELBOURNE / MAIL ORDERS:
289 LATROBE STREET, MELBOURNE, VIC. 3000
PHONE: (03)602-3499 FAX: (03)670-6006

CLAYTON: CNR. BLACKBURN & WELLINGTON RDS. PH: (03)562-9501 FAX: (03)562-9261
SHOP HOURS: MON.~THURS. 8:30~5:30 / FRI. 8:30~8:00 / SAT. 9:00~1:30

ADELAIDE: 223-2225 BRISBANE: 229-4086 DARWIN: 814-070 SYDNEY: 262-3093

NORMAL PRICES CHARGED UNLESS AD PRICES QUOTED. ERRORS & OMISSIONS EXCEPTED. PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

FREE CALL
MAIL ORDER HOTLINE
(1800)335-901
ALL MAJOR CREDIT CARDS ACCEPTED

High Performance Computer Systems

All **TECS** computer systems are assembled in-house by our own technicians using high quality, brand new parts. This enables us to maintain the top level of standard that our customers demand.

Our systems are proving their reliability and ruggedness in some of the finest institutions such as the Physics department at Victoria University, Dept. of Biochemistry at the University of Tasmania, Dept. of Elect. & Comp. Syst. Eng. at Monash University, and many others.

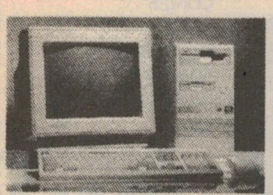
486SX-33 @$1395	486DX-40 @$1565
486DX2-66 @$1595	486DX2-80 @$1795

Configuration: 4M RAM, 210M HDD, 1.44M FDD, 1M SVGA card, 2S/1P/1G ports, 101 keyboard, 14" SVGA monitor, in your choice of desk-top or mini-tower case. (add $65 for MS-DOS 6.22)

This month only!! VL-bus IDE I/O, VL-bus SVGA card, 14" non-int. monitor at NO EXTRA COST!

2 Year parts and 5 Year labour warranty

486DX2-66 Multimedia System



MASSIVE 8M RAM 420M HDD

$2750

Configuration: 3 x VL-bus slot motherboard with 256K cache & AMI BIOS, 8M RAM, 420M HDD, 1.44M FDD, VL-bus IDE controller card with 2S/1P/1G ports, S3 based 1M VL-bus SVGA card, 14" non-interlaced SVGA monitor, Creative CR200 double speed CD-ROM drive, Sound Blaster 16 sound card, pair of amplified speakers, joystick, MS Ergonomic mouse, Spill-resist 101 keyboard, choice of either desk-top or mini-tower case, MS-DOS 6.22, MS Windows 3.11, Works for Windows CD, 3-D Dinosaur Adventure CD, SPEED Interactive Movie CD, New Grolier Encyclopaedia CD.

Enhanced IDE controller now included!!

Free delivery and setup for this system-- Metro Melb. area
2 YEAR PARTS & 5 YEAR LABOUR WARRANTY!!

Save!! Save!! Save!!



Quality diskettes at low, low price.

3.5 HD diskettes
Pre-formatted



$6.95

$6.50 for 100+
$5.90 for 1000+

Western Digital Hard disc drives

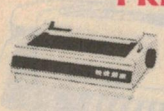


Top brand hard drives at an affordable price!!

210M	$285
270M	$320
340M	$350
420M	$390
540M	$480
730M	$625
1G	$865

Supports the NEW enhanced IDE drive specifications!!

PRINTERS





HP Portable with cutsheet feeder	$449
HP Deskjet 540	$575
HP Deskjet 560C (colour)	$1250
HP Laserjet 4L	$1225
Epson LX-300 9pin dot matrix	$279
Epson LQ-100 24pin dot matrix	$359
Epson Colour Stylus 720DPI inkjet	$1175
Canon BJ10SX with cutsheet feeder	$475

SEMICONDUCTORS

DUE TO WORLDWIDE SHORTAGE ON INTEGRATED CIRCUITS, THERE HAS BEEN A SIGNIFICANT INCREASE IN PRICES, SOME AS MUCH AS 100%!!

WE HAD TO INCREASE OUR PRICES, BUT WE BELIEVE WE STILL HAVE ONE OF THE CHEAPEST PRICES AROUND.

DIODES			
1N4148 (PK.100)	$3.50	1N914 (PK.100)	$4.00
1N4004 (PK.100)	$6.00	1N4007 (PK.100)	$7.00
1N5404 (PK.100)	$14.00	1N5408 (PK.100)	$16.00
BRIDGES			
W04 (PK.10)	$5.00	BR64 (PK.1)	$2.00
BR104 (PK.1)	$2.50	BR354 (PK.1)	$4.50
LED's			
3mm RED (PK.100)	$12.00	5mm RED (PK.100)	$12.00
3mm GRN (PK.100)	$15.00	5mm GRN (PK.100)	$18.00
3mm YLW (PK.100)	$15.00	5mm YLW (PK.100)	$18.00
TRANSISTORS			
BC547/8/9 (PK.100)	$8.50	BC557/8/9 (PK.100)	$8.50
BD139 (PK.10)	$6.00	BD140 (PK.10)	$6.00
MJ2955 (PK.1)	$2.00	2N3055 (PK.1)	$1.50
IC's			
324 (PK.10)	$9.00	339 (PK.10)	$8.50
555 (PK.10)	$8.00	741 (PK.10)	$7.00

Full featured Digital Multimeter



Check out the loads of great features available on this multimeter!! You won't find a meter this comprehensive at a price you can afford anywhere else.

NORMALLY $149

$99

Features:
- Large 3.75 digit display.
- Measuring rate of 2.5 times per second.
- Fused 20A current range.
- Auto power off.
- Housed in hi-impact plastic case.
- All the usual ranges plus logic indicator, transistor Hfe, capacitance, & frequency counter.

Ranges:
DC Voltage: 400mV, 4V, 40V, 400V, 1000V
AC Voltage: 400mV, 4V, 40V, 400V, 750V
DC Current: 40mA, 400mA, 20A
AC Current: 40mA, 400mA, 20A
Resistance: 400, 4K, 40K, 400K, 4M, 40M
Capacitance: 4nF, 40nF, 400nF, 4uF, 40uF
Frequency counter: 4KHz, 40KHz, 400KHz, 4MHz
Continuity & Diode test

Weller Soldering Equipment



Portasol P-1
Economy gas soldering iron
Sale price of **$49**



Pyropen WPA2
Professional class gas soldering iron.
Sale price of **$149**



WTCPS soldering station
The most popular iron in the entire range of Weller products.
Sale price of **$145**

POSTAGE RATES

$1.00 ~ $9.99	$3.50
$10.00 ~ $24.99	$3.95
$25.00 ~ $49.99	$4.75
$50.00 ~ $99.99	$6.25
$100.00~ $199.99	$7.25
$200.00~ $499.99	$7.95
$500.00 PLUS FREE	

CARRIER CHARGE:
METROPOLITAN MELBOURNE $7.00
COUNTRY VIC. & INTERSTATE $12.00

N.B. DOES NOT APPLY TO COMPUTER SYSTEMS. ONLY SMALL ITEMS WILL BE SENT BY POST.

PRICELIST ON DISK NOW AVAILABLE!!

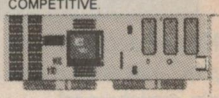
FREE with every mail order upon request or send $2.00 to cover postage & handling.

Send your business card to receive our TRADE pricelist on disk free of charge.

Please specify:
3.5" 1.44M or 5.25" 1.2M
Available in MS-DOS format only

PERIPHERAL CARDS

-WHETHER YOU'RE REPLACING A FAULTY CARD OR INSTALLING AN ADDITIONAL CARD, WE CAN OFFER YOU THE RIGHT CHOICE.
-COMPARE OUR PRICES WITH OTHER DEALERS' YOU'LL FIND OUR PRICES TO BE VERY COMPETITIVE.



XT/AT PARALLEL	$17.50
XT/AT GAMES	$17.50
AT MULTI I/O (2S,1P,1G)	$19.00
AT IDE/FDD	$19.00
AT IDE/FDD MULTI I/O ...	$25.00
MONO/CGA GRAPHICS ..	$45.00
512K TRIDENT VGA	$75.00
1M CIRRUS VGA	$109.00
VESA LOCAL BUS CARDS	
1M TRIDENT VGA	$109.00
1M CIRRUS VGA	$129.00
1M S3 VGA	$129.00
1M WD90C33 VGA	$149.00
2M CLOUD 9 VGA	$349.00
IDE I/O CONTROLLER ...	$39.00
CACHING IDE CONTROLLER PROMISE DC4030	$249.00

1 YEAR WARRANTY!!

Tax Exempt orders: TECS Wholesale P/L, 1st Flr. 289 Latrobe St., Melbourne, Vic. 3000 Ph:(03)670-6474 Fax:(03)670-6006

READER INFO NO. 17

S3 VL VGA CARD



Designed for VESA Local Bus, this Windows Accelerator Graphic Card is based on the S3PS86C805 chipset. It represent up-to-date technology available on the market today.

FEATURES:

- Graphic User Interface (GUI) acceleration designed to improve performance of applications running under Windows and DOS
- 24-bit True Colour in 640 x 480 resolution mode
- 100% register-level VGA compatibility and full-register-level CGA, HGC and MDA backward compatibility
- High performance BitBlt hardware line drawing and rectangle fill capability
- Expandable to 1M or 2M Bytes of DRAM
- Extended drivers for Windows 3.1, AutoCAD, AutoShade, 3D Studio, CADVance, CADKey/DataCAD, Generic CADD, MircoStation PC and VersaCAD. Extended text and graphics mode drivers for Lotus 1-2-3, Microsoft Word and WordPerfect
- 100% register-level VGA compatibility and full-register-level CGA, HGC and MDA backward compatibility
- Support for 72Hz verticalr efresh rate in 640 x 480, 800 x 600 and 1024 x 768 non-interlaced operating mode

X18167....**$169**

DISPLAY CAPABILITIES

Resolutions	1M DRAMS	2 M DRAMS
640 x 480	256, 64K, 16M	256, 64K, 16M
800 x 600	16, 256, 64K*	16, 256, 64K*
1024 x 768	16, 256	16, 256, 64K*
1152 x 864	256*	256*
1280 x 1024	16*	16, 256*

**This mode may require Multi-Sync Monitor, e.g, NEC 4FG, ADI Microscan 3E*

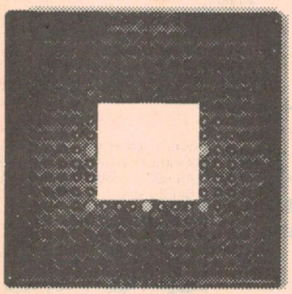
EPROM ERASER



This EPROM eraser has a timer that allow you to "set and forget" Choose from range of different settings from 15 minutes to 40 minutes depending on the instensity of the UV source. The chip door has a conductive foam pad.
Dimensions:
217 x 80 x 68mm

X14955 With buit-in timer.....$149
X14950 Without buit-in timer...$109
X14957 Spare UV Tube$17.95

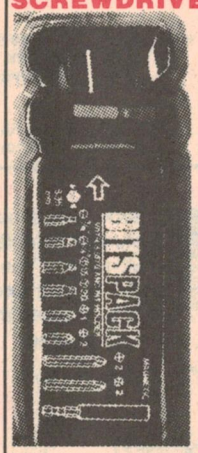
PIN STRAIGHTENER / CARRIER



Had an accident with your chip pins? Just stick it into this slotted pin straightener! A11420

$4.95

ELECTRICAL/BATTERY SCREWDRIVER DRILL BIT SET



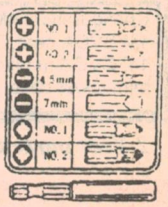
9-IN-1 POCKET BITS SET

- Chrome Vanadium Steel Bits

Easy to carry around and change quickly on the job. No more searching for the right bits!

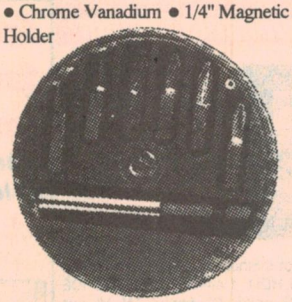
T12196
$16.95

ELECTRICAL/BATTERY SCREWDRIVER POWER BIT SET 7PCS



Convenient pack of 7 pcs drill bits. Buy a pack for the missus. Difficult to lose with its magnetic bits.

- Chrome Vanadium
- 1/4" Magnetic Bit Holder

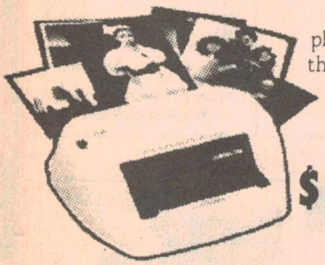


COMES WITH EXTENDER FOR THOSE INACESSIBLE AREAS



T12195
$8.95

LAMINATOR



Laminate your postcards size photos and save them from wear and tear.

A91100
$79.95



LAMINATOR SHEETS

Laminate Sheets come in 24 sheets

CAT NO	SIZES	PRICE
A91112	108 x 157mm (4 1/4" x 6 3/16")	$10.95
A91113	95 x 135mm (3 3/4" x5 5/16")	$10.95
Credit card in pack of 100s:		
A91110	85 x 55mm (3 3/4" x2 1/4")	$11.95

COMPACT PERSONAL SHREDDER PS 50



Now you can get rough and shred all your sensitive documents right where you work!

Complete with:

- Plastic Wastebin
- Automatic Start/Stop
- Reverse Function
- 230mm (9") entry width
- Shreds up to 5 sheets
- 6.3mm (1/4") shred width
- Compact, Light & Portable.

SUPA SPECIAL PRICING
$269



SPECIFICATIONS:

Transformer	240V ~ 50Hz 0.4 amp 14.8V/1.4Amp
Sheet Capacity	5 Sheets A4 Size 20 lb. Bond/80gm²
Throat Width	8 3/4 *(228mm)*
Shred Width	1/4" *(6.3mm)*
Dimensions -	
Shredder Only	15" x 4 7/8 x 2 3/4" *(380mm x 124mm x 70mm)*
Dimensions -	
Set-up with Wastebin	14 7/8" x 10 1/16" x 16 1/2" *(380mm x 255mm x 419mm)*
Weight	11 1/2 lbs. *(5.0kg)*
Power Cord Length	6 Feet *(1.9 metres)*

ERRORS & OMISSIONS EXCEPTED. PRICES CHANGE WITHOUT NOTICE.

QUADSCD

WE NOW OFFER 2 TOP-OF-LINE 486DX2-66 MULTIMEDIA SYSTEMS

WARNING: DON'T BUY OUT-DATED TECHNOLOGY. COME TO RIE FOR THE LATEST DX2-66 SYSTEM. WE ALWAYS HAVE THE LATEST PRODUCTS

AT A PREHISTORIC PRICE!

IDEAL FOR THAT XMAS GIFT OR LAYBY!

*3 HOUR EXPRESS DELIVERY SERVICE ON THIS SYSTEM ONLY!

THIS CD ROM DRIVE IS CD-I COMPLIANT

SOUND BLASTER MULTIMEDIA

$1899 EX. TAX **$2199** INC. TAX

486DX2-66 /420 HDD VESA LOCAL BUS 3 SLOT MOTHERBOARD FITTED

Here's another Value-Packed Budget-Priced MultiMedia 486DX2-66 System that will suit those who just want to enjoy the world of Music, Sound & Computer Games and yet is sufficiently powerful for that system intensive software! Place your order now!

INCLUDES: ● VESA 3 Slot Motherboard ● 4 MEG RAM ● VESA 1 MEG SVGA Card ● Mini Tower Case and 200W P.S. ● Ritron Mouse Pad ● 101 High quality keyboard ● Sound Blaster 16 Sound Card ● Joystick & Mouse ● Creative CD-200 2x Speed MultiSession CD ROM Drive (feature front panel play, pause & eject buttons. Listen to your favourite music CD at the touch of a button in true stereo)

MULTIMEDIA ENTERTAINMENT:
● SPEED Interactive Movie ● 3D Dinosaurs Adventure ● Groliers Encyclopedia ● Text to Speech ● Wave Studio ● Ensemble Remote Control ● Sound O'Le WAV Recorder ● Creative 8 Channel Mixer ● Mosaic Board Game ● CD Play Utility ● FM Intelligent Organ

*SUBJECT TO AVAILABILITY OF STOCK IN HAND

420MB HDD - GREAT VALUE!

HARDWARE/SOFTWARE CONFIGURATION FOR BOTH SYSTEMS:
- ☐ 1.44 -3.5" Floppy Disk Drive
- ☐ 14" Supa VGA Monitor -1024 x 768 0.28mm Dot Pitch
- ☐ VESA I/O Card
- ☐ Magnetically shielded Speakers
- ☐ MS DOS 6.2
- ☐ Windows 3.11

4 YEARS PARTS & LABOUR WARRANTY

FREE HOME DELIVERY & SETUP WITHIN MELBOURNE METROPOLITAN AREA

486DX2-66 MULTIMEDIA SYSTEM PRO

$2399 EX. TAX **$2795** INC. TAX

SOFTWARE BONUS EXTRAS!! MS 1994 ENCARTA, MS MONEY, PHONEDISC

CPU OPTIONS	TAX INC	TAX EX
486DX2-50	$2699	$2250
486DX-40	$2669	$2205

$3 VESA VGA GRAPHIC CARD PRO

LATEST TECHNOLOGY - PENTIUM 60/66 UPGRADABLE MOTHERBOARD

This is an enhanced version of our basic 486DX2-66 MultiMedia System. It offers faster graphics, expansion flexibility in a midi tower case and upgradability to the Pentium CPUs & Pentium OverDrive chips. Don't settle for anything less!

540MB HDD/FAST ATA BUS CONT CARD

INCLUDES: ◆ VESA LB components, including: I/O Card, Video Card & Motherboard. ◆ 4MB SIMM RAM exp to 128MB ◆ Midi Tower Case and 200W P.S. ◆ Chicony high quality keyboard ◆ Internal Photo CD, CD ROM drive which plays the latest video software. ◆ 16 Bit Sound Card (SBlaster compatible) ◆ Joystick ◆ MS Mouse ◆ MS Works for Windows* ***PREINSTALLED***, $1,000 of value compared to what you used to pay for individual programs! Spreadsheets, Database, Word Processing and Mailing Lists all intergrated in one program. Learn these useful programs at your own pace, with the in-built help text and illustrated tutorial!

Microsoft 1994 Encarta - Saves hours in the library. Easy to find information. Funk and Wagnalls 29-volume encylopedia with more than 1,000 additional articles, eight hours of sound, 60 languages samples, 7,800 photos & ilustrations, 100 animations & video clips, 800 maps, 100 interactive charts and an atlas all on a CD-ROM.

Microsoft Money - Personal financial organisation made easy. Has a calculator, currency conversion module. Easy spreadsheet and on-line bank payment or transfer capability.

Phonedisc - The latest in Australian Directory Assistance. Allow you to find virtually any business numbers in Australia, including Fax Numbers.

FREE 3 HOUR COMPUTER TRAINING COURSE- MELBOURNE ONLY

USE YOUR DINERS CLUB/AMEX CARDS TO GAIN R.YER POINTS! APPLYS TO THIS MULTIMEDIA SYSTEM PRODUCT OFFER ONLY.



ULTRA MULTIMEDIA SYSTEM

$3499 TAX EX **$3995** TAX INC

-PENTIUM 60
-Play CDI Movies

Fitted with a Pentium 60/66 upgradable motherboard & comes with a **Grand MPEG Card** and **CD-I compliant CD ROM drive** that let you watch *CD-I/MPEG movies* on your PC!

CONFIGURATION: ● Midi Tower 200W P.S. ● Pentium 60/66 Upgradable Motherboard - 256KB cache (Exp to 512KB) memory. Main memory exp to 128MB. Two 32-bit VL-Bus & seven ISA slots. Accepts 486DX2 to Pentium 66 CPUs. ● Pentium 60 CPU fitted (Optional AMD 486DX2-80 CPU) ● 8 MB RAM ● 540 MBtyes HDD fast ATA enhanced HDD ● 1.44 FDD ● VESA Enhanced IDE M/ I/O card ● VESA S3 VGA I Grand MPEG Player ● 3 x CD-I Movies, a choice of titles- select from Top Gun, Adam's Family, Wayne's World, Eric Clapton and more ● SBlaster OEM CD MultiMedia Pack or OEM 16 bit Sound Card/Wearnes 120 IDE CD ROM Drive ● OEM Shielded Speakers ● 15" Analog Moni ● MS DOS ● MS Windows ● MS Works ● MS Money ● MS Encarta ● MS OEM Ergonomic Mouse ***SUPERB HOME OFFICE/ENTERTAINMENT SYSTEM***

ON DISPLAY AT OUR CITY STORE. WATCH CD-I MOVIES RUNNING ON 17" MONITOR & 26" (68cm) T.V.

COMPUTER SYSTEMS

FREE 3 HOUR TRAINING COURSE (MELB. ONLY) FOR ALL COMPUTER SYSTEMS INCLUDING MULTIMEDIA SYSTEMS

DOS 6.2 SETUP WAS $22 NOW $15

386DX 40 $1040 Tax Inc $1259	With upgradable motherboard 486SX 33 $1239 Tax Inc $1499	CYRIX CPU 486DX 40 $1239 Tax Inc $1499
CYRIX CPU 486DX2 50 $1259 Tax Inc $1519	486DX2 66 $1299 Tax Inc $1579	NEW! 486DX2 80 $1569 Tax Inc $1879
486DX4 100 $1989 Tax Inc $2399	PENTIUM 60 External 256K Cache $1795 Tax Inc $2171	PENTIUM 90 External 256K Cache $2499 Tax Inc $2999

DISCOUNTED SOFTWARE

DOS 6.22	*$89
M.S WORKS	*$99
DOS 6.22 & Win 3.11	*$149
DOS 6.22 & Windows for WorkgroupS	*$179
MS MONEY	*$44
MS BOOKSHELF	*$99
MS Encarta	*$129
MS Office	*$695

* When purchased with a system only.

4 YEAR PARTS & LABOUR WARRANTY

All systems include 260 MEG Hard Disk ● 4 MEG RAM ● 101 Keyboard ● 14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor - 2 SPG Ports ● 1 44 MEG 3½"/FDD ● Mini or Baby AT casing ● 3 Slots VESA Local Bus Motherboard & VESA Local Bus 1MB VGA Cards are supplied in 486 machines AT NO EXTRA COST (Up to 1280 x 1024) Resolution)

★★★★★★ CASH SPECIALS ★★★★★★

ONLY AVAILABLE WHEN PURCHASING SYSTEMS: CREATIVE LABS CD-ROM DRIVE & SOUND BLASTER 16 VALUE EDITION AUDIO CARD *INCLUDING DRIVERS, CABLES AND THREE SOFTWARE CD TITLES: SPEED ● THE NEW GROLIERS ENCYLOPEDIA ● 3D DINASOURS.* **SUPA SPECIAL $495**

MEMORY

30 PIN SIMM	1-9	25+	100+
1M x 9-60 With Parity	$79	$77	$75
1M x 9-70 With Parity	$65	$63	$59
4M x 9-70 With Parity	$239	$229	$219

72 PIN SIMM FOR PENTIUM M.B

4M X 8-70 No Parity	$259	$245	$239
4M X 9-70 With Parity	$279	$265	$259
8M X 9-70 With Parity	$549	$529	
16M X 9-70 With Parity	$1099	$1049	

HARD DRIVES VOICE COIL IDE HD

Cap	Av.Access	Tax Inc.	Tax Ex.
212M	16ms	$272	$225
260M	16ms	$277	$229
345M	12ms	$359	$298
420M	12ms	$399	$328
540M	12ms	$482	$398
#730M	10ms	$615	$509
#810M	10ms	$839	$695
#1.08GB	10ms	$999	$825

#These drives come with Disk Management Software to overcome DOS limitations. (Drives will normally goes to 525MByte max).

EPSON PRINTERS

DISCOUNTED PRICING!!

LX300 *264 Cps Draft, 9 pin dot matrix*	$249
LQ100 *200 Cps Draft, 24 pin dot matrix*	$279
LQ150 *216 Cps Draft, 24 pin dot matrix*	$369
With colour option	$399
Stylus 400 *48-nozzle inkjet, 180Cps, 360dpi*	$469
Stylus 800+ *48-nozzle inkjet, 255Cpi, 360dpi*	$559
Stylus Colour *200Cpi, 360/720dpi full colour*	$1149
EPL 5200 *300dpi, 6ppm, laser printer*	$1299
EPL 5600 *600dpi, 6ppm, laser printer, RISC*	$1699

CD ROM DRIVES

WEARNES OEM DUAL SPEED CD ROM MULTIMEDIA KIT *with 16-bit Sound Card instructions & software* $379

WEARNES CDD-110 DUAL SPEED CD ROM IDE DRIVE *with instructions & software* $239

WEARNES CDD-120 DUAL SPEED CD ROM IDE DRIVE *with instructions & software* (CD-I Compatible) $249

562B CD ROM DRIVE DOUBLE SPEED *with software drivers for all drives* $239

563B CD ROM DRIVE DOUBLE SPEED *works with all Sound Blaster Cards* $289

NEW MPEG CARD $595

Display CD-I movies on CRA monitor! Due in one week

STYLUS INKJET COLOUR $1149
720 DPI (special paper stock) COLOUR A4

SOUNDBLASTER CARDS

NEW Sound Blaster Pro VALUE EDITION with Lemmings & Indy 500	$119
Sound Blaster Deluxe	$69
Sound Blaster 16 bit	$189
ASP Chip	$99
Video Blaster SE	$479
Video Blaster FS200	$599
Game Blaster CD16 Pk 7 CD Titles	$799
TV CODER	$279
16 bit Discovery Pack CD16	$499
8bit Discovery Pack CD8	$469

PRICE CRASH

NEW DYNALINK MODEMS

1414VQE *HIGH-SPEED DESKTOP FAX MODEM*
V.32bis (14.4 kps) data & fax modem $399
Includes Bitfax Professional/Win

GREAT SOFTWARE FOR WINDOWS SUPPLIED!

1414VQH *HIGH-SPEED IBM CARD FAX MODEM* V.32bis (14.4 kps) data and fax modem. $325
Bundled with Winfax LITE

NEW MONITOR RANGE:

All these superb monitors on display at all Stores

- **14" Super VGA** 1024x768 (0.28mm Dot Pitch) $369
- **14" Non-interlaced** 1024x768 (0.28mm Dot pitch) $399
- **15" XGA Analogue** 1280x1024 $499
- **15" XGA Digital** 128x1024 $599
- **#15" XGA Digital MPRII** 1280x1024 $749
- **#17" XGA Digital MPRII** $1299

#15" & 17" Digital Monitors comes with Economy Management Software.

MOTHERBOARDS

386SX-40* LM 47	$129
386DX-40* 8K Internal Cache LM63	$169
386DX-40* 128K Internal Cache LM58	$199
486DX-40* 256K Cache L.B. CYRIX CPU	$359
486DX2-66* 256K Cache L.B	$489
486DX2-80* 256K Cache L.B	$795
486DX4-100 256K Cache L.B	$1395
***NEW* PENTIUM 60MHz/256 C** exp to 512K **PCI/ISA VESA/ISA**	$1189
***NEW* PENTIUM 90MHz PCI/VESA**	$1089
***NEW* PENTIUM 100MHz PCI/VESA**	$1889
AMD CPU. Without Asterisk- INTEL CPU	$2695

BULK DISK PRICES

All disks come with Write Protects and envelopes and a life time warranty.

PRICES ARE PER BOX OF TEN DISKS

DESCRIPTION	1-9	10+	50+	100+	500+
5¼ DS/DD	$4.50	$4.50	$4.50	$4.30	$3.95
5¼ DS/HD	$7.95	$7.75	$7.50	$6.90	$6.90
3½ DS/DD	$6.95	$6.80	$6.75	$6.50	$6.00
3½ DS/HD	$6.95	$6.80	$6.50	$6.25	$6.00

Scanmate 32

10 only!!

ScanMate/32 offers Black & White scanning with 32 halftones at a very economical price..... **$119**

A HAND SCANNER FOR ONLY $119- A GREAT XMAS PRESENT

BACK IN STOCK... CUP WEEK SUPA SPECIAL. WAS $229

ScanMate 256 offers 256 grey scales scanning **$199**

NEW HP DeskJet 540 InkJet Printer

The Black and White printer with a colourful future. Packed with all features like fast print speed, media flexibility from A4 to envelope printing, high resolution and DOS/Windows compatibility. And it's all ready to splash out in full colour with a simple colour upgrade kit!

FEATURES:
- 600 x 300dpi black printing
- 167 CPS at 10 CPI
- Compact and quiet
- Uses your current DOS, Windows or OS/2 software
- 4 Buit-in typefaces plus hundreds of combinations with Windows scalable fonts
- Uses plain paper, multiple transparencies, up to 20 envelopes, and card stock
- 3 pages per minute. EconoFast mode - even faster printing for draft copies
- Print Method: Plain paper drop-on-demand thermal inkjet printing
- Add-on Colour Kit *for bright, vibrant colour*

Optional Colour Upgrade Kit only a $100.00 extra! INC TAX

$499 EX TAX **$599** INC TAX

LIMITED STOCK

3 YEAR LIMITED WARRANTY

SOUND BLASTER CD ROM UPGRADE KIT

NEW

Combine this CD ROM upgrade kit with your Sound Blaster Pro, SB16 series and AWE32 to create a complete multimedia system

...only $289

Comes with Creative Double Speed CD ROM Drive-CR563 that is Multi-session & PhotoCD compatible.

101 KEYBOARD

Update now!

With 2 year warranty. 1-9 **$26.95** 10+ **$24.00**

ROD IRVING ELECTRONICS PTY. LTD

FOR THE SERIOUS COMPUTER USER Est. 1977 A.C.N. 005 428 437

FREE CATALOGUE
ERRORS & OMISSIONS EXCEPTED. PRICES CHANGE WITHOUT NOTICE.

HEAD OFFICE: 56 Renver Rd Clayton, Victoria, 3168 Ph: (03) 543 7877

MELBOURNE:	48 A'Beckett St. City.	Ph:(03) 663 6151.
OAKLEIGH:	240C Huntingdale Rd.	Ph: (03) 562 8939.
NORTHCOTE:	423 High St.	Ph: (03) 489 8866.
BOX HILL:	1031 Maroondah Hwy.	Ph: (03) 899 6033.
ADELAIDE:	241-243 Wright St.	Ph. (08) 211 7200.
SYDNEY:	74 Parramatta Rd, Stanmore.	Ph: (02) 519 3888.

Computers (03) 639 1640
Fax:(03) 562 8940
Fax:(03) 489 8131
Fax:(03) 899 0156
Fax:(08) 211 7273
Fax:(02) 516 5024

BLUESTAR COMPUTERS: 271 Maroondah Hwy. Ringwood Ph: (03) 870 1800
Fax:(03) 879 3027 TRADING HOURS: Mon/Fri 9am - 5.30pm.Sat 9am - 1pm

City store open till 8pm on Fridays. Box Hill store open till 3pm on Saturdays.

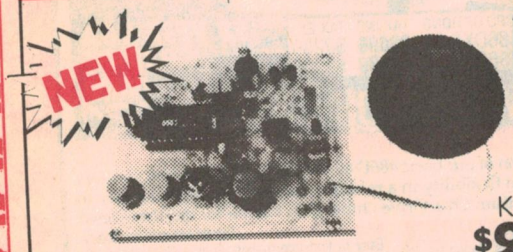
Tax Exempt sales: RITRONICS WHOLESALE Ph.(03) 543 2166 Fax.(03)543 2648
RIE BULLETIN BOARD Ph: (03) 562 7877 For Specials, info & Shareware
MAIL ORDER: Ph:(03) 543 7877 Fax:(03) 543 8295
Mail Order Hotline 1-800 33 5757 GG271094

ROD IRVING ELECTRONICS PTY. LTD.

YOUR FIRST CHOICE IN QUALITY ELECTRONICS A.C.N. 005 428 437 ESTABLISHED SINCE 1977

NEW KITS NEW KITS NEW KITS

75 SECOND MESSAGE RECORDER



This 75-second message recorder runs from a 6V battery and features more power output, a pause button, 75 seconds of continuous recording time and zero-power memory storage.

Silicon Chip Feb'94

K10476 **$93.95**

Soon available - 90 Second Message Recorder...

K10475....$97.95

K10595 **$29.95**



NICAD ZAPPER

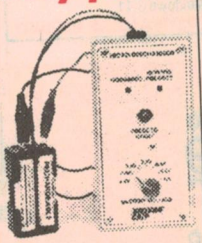
Do you have a few suspect nicad batteries lying around in your kitchen drawer? Why not try bringing them back to life with this Nicad Zapper? It zaps the cell with a high-voltage, high-current burst to blast away any internal shorts caused by dendrites.

Silicon Chip August '94

Automatic discharger for nicad battery packs

If you own equipment which uses nicad batteries, then this discharger is for you. Use correctly, it will maintain the full capacity of your battery pack & extend its useful life. It can even rejuvenate an old battery pack that's suffering from the memory effect.

Silicon Chip Sept '94

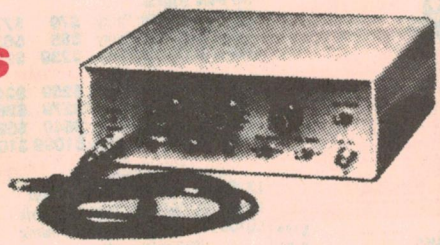


K10620 **$27.95**

AN IMPROVED DSO ADAPTOR FOR PC'S

Use this audio DSO to display, store and output samples waveform from your PC. It uses only a small number of low-cost ICs. Features a calibrated vertical amplifier, with a maximum input sensivity of 1V full scale, a calibrated sampling timebase, circuitry which allows direct control from PC software.

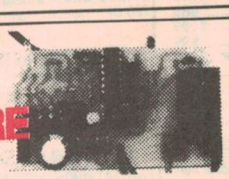
EA Feb '94



K10520 ***NEW LOW PRICE*** **$188.95**

K10521 *With ADC08061* **$198.95**

BUDGET PRICED TEMPERATURE CONTROL



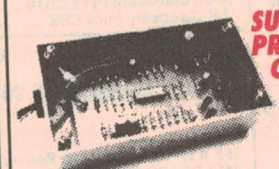
This handy and compact unit can switch 10 amps at 240V AC under the control of a temperature sensor - and it's budget-priced. The temperature setting must be calibrated manually, but can be set from sub-zero temperatures, to around 100 degrees Celsius or more. A PCB jumper allows the unit to be set to switch the circuit's relay either on or off when the desired temperature is exceeded.

EA August '94

K10580 **$39.95**

Build a coolant level alarm for your car

GREAT FOR SUMMER TIME! PROTECT YOUR CAR ENGINE !



K10570 **$29.95**

This coolant level alarm will warn you if the water level in your radiator drops below a preset level.

It could prevent serious damage to your engine & hence avoid a very expensive repair. ***Silicon Chip June '94***

We always have the latest in components and products.

ERRORS & OMISSION EXCEPTED. PRICES CHANGE WITHOUT NOTICE

EAKITD94

ROD'S HOTLINE 1-800 33 5757

MAIL ORDER LOCAL CALLS: (03) 543 7877

KITS KITS KITS KITS KITS KITS KITS

CAT	Description	R.R.P
K10005	SOLAR VOLTAGE REGULATOR	$13.95
K10040	ETI 480 50W AMP	$27.95
K10045	ETI 480 100W AMP	$34.95
K10050	ETI 480 POWER SUPPLY	$28.95
K10055	GENERAL PURPOSE PRE-AMPLIFIER	$14.95
K10060	BALANCED MICROPHONE AMPLIFIER	$12.95
K10065	GENERAL PURPOSE AMPLIFIER	$14.95
K10070	BALANCED INPUT DIFFERENTIAL PREAMP	$19.95
K10075	FLOAT NICAD CHARGER	$14.95
K10080	TRANSISTOR TESTER	$22.95
K10085	300W PLAYMASTER AMP	$119.00
K10095	2 TONE ALARM	$9.95
K10100	1.5V TO 9V DC CONVERTER	$13.95
K10105	3 DIGIT COUNTER	$23.95
K10110	ELECTRIC FENCE	$23.95
K10115	ELECTRIC FENCE CONTROLLER	$61.95
K10120	TV PATTERN GENERATOR	$109.00
K10125	UNIVERSAL POWER SUPPLY	$12.95
K10135	LED SCANNER	$17.95
K10140	LOW FUEL INDICATOR FOR CAR	$11.95
K10145	SCREECHER CAR ALARM	$36.95
K10150	12/24V LIGHT CHASER	$21.95
K10155	LOW VOLTAGE CUTOUT FOR CAR /BOAT	$22.95
K10200	IN-CIRCUIT TRANSISTOR TESTER	$14.95
K10205	VHF POWERMATCH	$74.95
K10215	TEMPERATURE PROBE FOR MULTIMETERS	$19.95
K10225	18V / 1AMP BENCH TOP POWER SUPPLY	$79.95
K10260	INVERTER 2KW (NON ASSEMBLED)	$1,495.00
K10265	INVERTER 2KW ASSEMBLED & TESTED	$1,895.00
K10295	LOW OHMS METER	$29.95
K10300	TEMPERATURE ADAPTOR	$24.95
K10305	VOICE OPERATED RELAY	$19.95
K10310	IGNITION KILLER	$22.95
K10315	HEADPHONE AMPLIFIER	$34.95
K10320	VIDEO RF MODULATOR	$17.95
K10325	50W AUDIO AMPLIFIER	$54.95
E10325	PCB 50W AUDIO AMPLIFIER TDA1514A	$19.95
K10335	RGB TO PAL ENCODER MODULE	$49.95
K10340	CAMCORDER MIXER	$29.95
K10345	KARAOKE BOX	$28.95
K10350	REMOTE CONTROL EXTENDER FOR VCRS	$32.95
K10355	HIGH ENERGY IGNITION	$65.00
K10360	LOUDSPEAKER PROTECTOR	$29.95
K10365	NICAD BATTERY DISCHARGER	$27.95
K10370	PORT. 12V LEAD ACID BATTERY CHARGER	$27.95
K10375	15W 12-240V INVERTER	$49.95
K10380	1GHz DIGITAL FREQUENCY COUNTER	$147.95
K10390	LOW COST QUIZ GAME ADJUDICATOR	$34.95
K10400	WOOFER STOPPER	$55.95
K10405	COLOUR VIDEO FADER	$32.95
K10415	PC-CONTROLLED EPROM PROGRAMMER	$99.95
K10425	DELUXE CAR ALARM	$55.95
K10430	REMOTE CONTROL ELECT. COCHROACH	$69.95
K10440	HIGH EFFICIENY FLUORO INVERTER KIT	$49.95
K10445	IMPROVED DECODER FOR ACS SIGNALS	$19.95
K10450	A SIMPLE LOW VOLTAGE SPEED CONTROLLER	$13.95
K10455	PRINTER STATUS INDICATOR FOR PRINTERS	$65.95
K10465	LOW COST 25W AMPLIFIER MODULE	$18.95
K10460	VERSATILE 40V / 3A LAB POWER SUPPLY	$165.95
K10465	LOW COST 25W AMP MODULE	$18.95
K10470	CHAMP 0.5 WATT AMPLIFIER	$9.95
K10475*	90 SECOND MESSAGE HOLDER	$97.95
K10476	75 SECOND MESSAGE HOLDER	$93.95
K10480	CONTROL STEPPER MOTORS WITH YOUR PC	$65.95
K10485	EGO TESTER KIT	$19.95
K10490	LOW COST MIDI BREAKOUT BOX	$32.95
K10495	200W INVERTER KIT	$199.95
K10500	VOICE OPERATED AUDIO SWITCH	$12.95
K10505	SIMPLE LED CHASER	$21.95
K10510	LEVEL CROSSING DETECTOR FOR MODEL RAILWAYS	$27.95
K10515	SOUNDS & LIGHTS FOR LEVEL CROSSING	$37.95
K10520	AN IMPROVED DSO ADAPTOR FOR PC'S	$188.95
K10521	DSO ADAPTOR (INCLUDES ADC08061)	$198.95
K10525	WEEKLY REMINDER TEMP	$19.95
K10530	L/NOISE UNI. STEREO PREAMP	$19.95
K10535	LIGHT & SOUND TRIGGER	$41.95
K10540	50W AUDIO AMPLIFIER	$37.50
K10545	IND. METAL BALANCE DETECTOR	$58.95
K10550	FAST CHARGER FOR NICAD	$42.95
K10555	DUAL LECTRONIC DICE	$24.95
K10570	COOLANT LEVEL ALARM	$29.95
K10575	STEAM TRAIN WHISTLE & DIESEL HORN SIMULATOR	$22.45
K10580	BUDGET PRICED TEMPERATURE CONTROL	$39.95
K10585	HIGH-POWER DIMMER FOR INCANDESCENT LAMPS	$69.95
K10595	NICAD ZAPPER	$29.95
K10600	GO/NO-GO CRYSTAL CHECKER	$19.95
K10605	CHAMP PRE-AMP	$9.95
K10610	.MINIVOX VOICE OPERATED RELAY	$14.95
K10615*	LONG-WAVE AM RECEIVER FOR AIRCRAFT WEATHER INFORMATON	$49.50
K10620	AUTOMATIC DISCHARGER FOR NICAD BATTERY PACKS	$27.95
K10625*	ELECTRONIC BALLAST FOR FLUORESCENT LAMPS	$59.95
K10630*	TALKING HEADLIGHTS REMINDER	$79.95
K10635*	BEGINNER'S VARIABLE DUAL-RAIL POWER SUPPLY	$59.95

*SOON AVAILABLE

ROD IRVING ELECTRONICS PTY LTD

YOUR FIRST CHOICE IN QUALITY ELECTRONICS

A.C.N. 005 428 437

WE STOCK THE LATEST RANGE OF ELECTRONIC PRODUCTS

WATCH TV ON YOUR PC!

HITUNER

Turn your PC monitor into a TV. Great for those who need to keep up to date with current news that relates to their work!



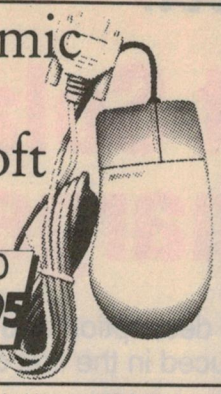
- **Tuner On Board** - Receives UHF/VHF or cable TV signals. Available in PAL AUSTRALIA.
- **TV Remote Control** - Software controls for channel preset, selection, fine tuning, and for volume, treble, bass and stereo modes. Think of it as your TV remote control.
- **Excellent Output** - Video output to VCR or HiVideo/PRO frame capture card to watch TV programs. Two watts per channel stereo output.
- **Software** - Bundled DOS and Windows TV control programs.

X18194

$229

HiTuner needs HiVideo/PRO or other video card to display TV video signal on your monitor and a Sound Card.

Ergonomic Naked Microsoft Mouse



X19800

$69.95

LATEST CPU PRICE

intel CPU		AMD CPU	
486SX-33	$179	486DX-40	$349
486DX-33	$399	486DX2-50	$379
486DX2-50	$399	486DX2-66	$379
486DX2-66	$429	486DX2-80 *NEW!*	$579
486DX2-50 OverDrive Chip	$499		
486DX-50	$899	**CYRIX CPU**	
486DX-75	$895	486DX-40	$329
486DX4-100	$1099	486DX2-50	$369
PENTIUM 60MHz	$799		
PENTIUM 66MHz	$999		
PENTIUM 90MHz	$1395		
PENTIUM 100MHz	$1795		



AVAILABLE ON ORDER THROUGH OUR STORES OR BY MAIL ORDER

CREATIVE BLASTER CD 16 MULTIMEDIA OFFICE



$1029

X17242

Sound Blaster CD16 combined with **Microsoft Office** - a full featured Windows business intergrated applications that include **Word, Excel, Powerpoint, Access** and also a workstation license for **Mail.**

Create quality documents with ***Microsoft Word*** and import information from other Microsoft programs.

Route your documents for review with ***Microsoft Mail.*** Include files, charts, graphics and more in your mail message.

Create and manage data fast with ***Microsoft Access.*** Then send your data to Microsoft Excel for further analysis. With Microsoft Access.

Microsoft Excel 5.0 - the most popular spreadsheet for Windows. Add data directly to a chart with Drag-and-plot; easily work with other data using Autofilter, Sort and Subtotal.

Microsoft PowerPoint 4.0 - the most popular presentation graphivs programs for Windows. Present your ideas more effectively and create a visual presentation fast.

PACKAGE INCLUDE: SB 16-bit Sound Card ● Headphone ● Microphone ● Creative double-speed CD-ROM Drive ● Software - Creative VoiceAssist™ MS Windows Sound System 2.0 ● Microsoft Encarta CD ● Microsoft Office.

INSTALL FREE ON YOUR PREMISES. APPLY ONLY TO WITHIN 50KM OF OUR SERVICE CENTRE AT CLAYTON.

(1 HOUR ALLOWING. ON-SITE NORMAL SERVICE CHARGE APPLY FOR LONGER DEMOS CURRENTLY $75 PER HOUR.)

COMMANDER HANDSET REPLACEMENT CORDS



Y16091 Cream coloured suits "N" model phones 2.0M.....$7.95

Y16093 Dark brown coloured suits "S" model phones 2.0M.....$9.95

Y16094 Light grey coloured suits "AN" model 2.0M.....$7.95

Y16095 Light grey coloured suits "BN" model phones 2.0M.....$7.95

COMPUTER CARDS - HUGE RANGE!!

I.S.A.

CAT NO.	DESCRIPTIONS	PRICE
X18075	1meg Trident/Cirrus VESA	$129
X18077	512K TRIDENT VEGA	$89
X18004	IDE/SPG	$29
X18013	IDE	$19
X17072	ADAPTEC SCSI 16bit 1522A	$199
X18161	*16bit ETHERNET NE2000	$99
X18169	16bit NE2000+	$269
X18151	S.P.G.	$29
X18030	2xRS232 STD	$39
X18017	Printer Port Lpt 1 Card	$19
X18181	Printer 2-Port Slct Lpt 1-2 Card	$29
X18190	Printer Port Slct Lpt 1-2-3 Card	$39
X18141	High Speed Serial Card 1-Port 16550	$59.95
X18041	High Speed Serial Card 2-Port 16550AFN	$99
X18143	High Speed Serial Card 4-Port 16550AFN S.P.G with 1655 UART CHIP	$199 $44.95
X18019	Games Card	$19
C14260	SMART GAMES Cont	$49
X18177	CD ROM Controller	$45
X19936	ISA Scanner Card GS4500	$99
X17071	ISA VGA Accelerator Pro	$275
	2.88 FDD Controller Card	$125

Specifications subject to changes. *X18161 without Boot Roms.

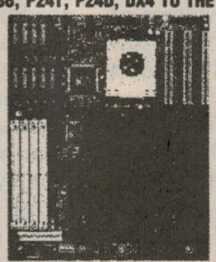
486 VESA MAINBOARD NEW

DX4-100 MOTHERBOARD

THE MOTHER OF ALL MOTHERBOARD THAT IS COMPATIBLE WITH EVERY CHIP FROM 486DX2/DX/SX/SL ENHANCED 486, P24T, P24D, DX4 TO THE CYRIX CPUs.

FEATURES:

- Fully AT compatible. Supports 486DX2/DX/SX/SL Enchanced 486, P24T, P24D, 486DX4 (P24C) and Cyrix CPUs.
- Supports internal cache (CPU) write-back (P24T, P24D, M6/M7) systems
- Memory configuration from 1 MB to 96MB using combinations of 70ns 256K, 512K, 1M, 2M, 4M and 16M SIMM modules. Uses four 72-pin DRAM Banks in multiple configurations
- Seven 16-bit slots, two master VESA slots, and one slave VESA slot



X18409

$249

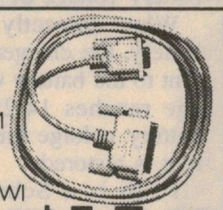
VESA LOCAL BUS

CAT.	DESCRIPTION	PRICE
X18002	IDE SUPER I/O	$39
X18099	VESA 1 Meg TRIDENT	$139
X18100	VESA CIRRUS 5428	$199
X18184	VESA PARADISE 1Meg	$299
X18186	VESA IDE Cache Cont	$349
X17071	VESA SCSI 2, IDE, Floppy, Multi I/O	$299
X18087	VESA WD Accelerator Video Card	$209
X18167	VESA VGA S3 Accelerator	$199
X18185	VESA ET-4000 TSENG LABS	$245
X18149	VESA CLOUD9 VGA 2 MEG	$449
X18047	VESA IDE ENHANCED MULTI I/O	$139
X18182	VESA CACHED IDE MULTI I/O	$280

P.C.I.

CAT.	DESCRIPTION	PRICE
X17900	PCI 1M VGA	$299
X18179	PCI IDE CONTROLLER	$99
X18181	PCI DIAMOND VIPER 2MEG	$999

MODEM CABLE DB9F - DB25M WI



P19015 **$15.95**

HIGH END LOW-COST COLOUR SCANNING

Affordable range of colour scanners with the choice of 1200 dpi or 24000 dpi

ColorPage-I

1200 dpi flatbed scanner

$1299

X19933



$1799

X19934

Have your DTP efforts been deterred or limited by high-cost colour scanners? Wait no more. Here's a couple of high-end colour scanners at prices we all can afford to pay!

- **Brilliant colour** - add the power of brilliant 24 bit true colour images to your Window-based DTP and presentation packages.
- **High resolution** - up to 1200 dpi (ColorPage-I)/2400 dpi (ColorPage II), get scanned pictures that are clear and beautiful.
- **Powerful image software** - PhotoFinish 3.0 software provides 87 tools to satisfy your demands and realize your creativity.
- **TWAIN compliant** - expands scanner capabilities with compatible applications.

Includes:

Interface card, PhotoFinish 3.0, MediaMate Presentation software, TWAIN driver, User's manual.

ColorPage-II

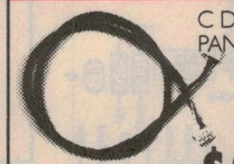
2400 dpi flatbed scanner

OPTIONAL:

- **Power OCR** - optional Recognita Plus OCR means you'll never have to re-key data again. **Auto-Document Feeder** (ADF-I) and **Transparency Unit** (TMA-I).

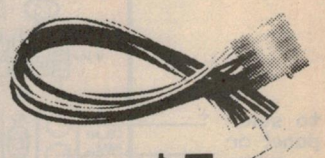
COMPUTER CABLES

C D AUDIO CABLE PANASONIC



P19084 **$29.95**

3-H Drive "Y" POWER CABLE



P19056 **$5.95**



UNIVERSAL C D AUDIO CABLE ADAPTOR Suitable for Mitusmi, Sony & Panasonic CD ROM Drive

P19086 **$24.95**

MAC CABLE MINOIN 8P - DB25M



P19027 **$15.95**

ERRORS & OMISSION EXCEPTED. PRICES CHANGE WITHOUT NOTICE.

Construction Project:

Intelligent Solar Battery Charger - 2

This month we present the circuit description and details of how to build and use our new lead-acid battery charger, which was introduced in the first of these articles.

by CONRAD MARDER

A quick overview should help you understand the operation of the regulator, which is really quite sophisticated. The block diagram of the circuit was given last month, which you might want to refer to.

The circuit has an oscillator that supplies a 200kHz square wave to a voltage multiplier. The DC voltage output of the multiplier turns on a power MOSFET, and all current from the DC source (solar panel or external DC power supply), flows through the MOSFET and a Schottky power diode. The diode prevents the battery discharging into the regulator or the DC source. A Schottky diode is used, rather than a silicon diode, because it has a much lower voltage drop (and hence lower energy loss).

The oscillator is turned on or off by logic circuitry, which compares a reference voltage and a sample of the battery voltage. When the oscillator is running, the MOSFET is on, and the battery is being charged.

A LED indicator is also controlled by the logic circuit. When the LED is flashing, the MOSFET is on and the battery is being charged. When the battery is not being charged, the LED is on continually, indicating power is being applied to the regulator. Now here's the details...

How it works

We'll start with the logic circuitry. A reference voltage of 2.5V is provided by IC1, an LM385-2.5. This device has been chosen as it is much more stable than a zener diode and needs only 10 microamps to operate. The reference voltage is applied to the non-inverting input of IC2a, a voltage comparator with a small amount of hysteresis provided by R4 and R22.

The network of R3, R5, R2 (for 24V operation) and VR1 provides a sample of the battery voltage to the inverting input of IC2a. The hysteresis voltage of the comparator is about 0.5V at a battery voltage of 14V volts, and 1V for a battery voltage of 28V.

When correctly adjusted for a 12V battery, the charger will switch off current to the battery when the battery voltage reaches 14.2V. It's not until the battery voltage falls to 13.7V that current is restored.

IC2b is a Schmitt oscillator that switches the LED on and off at a low duty cycle, as set by the ratio of R9 and R10. The oscillator operates only when the output of IC2a is high, as gating diode D1 is reverse biased. Otherwise the inverting input of IC2b is held low, sending its output high.

The oscillator therefore operates only when the battery voltage is below the upper threshold voltage of 14.2V. Because of the low duty cycle of the oscillator, the power consumption of the LED is very small. As well, a high-intensity LED is used to give good brightness with low current.

When the battery voltage rises above the upper limit, the output of IC1a goes low, which disables the oscillator and switches the LED on constantly. This condition remains until the battery voltage falls below the lower hysteresis limit (13.7V). Diodes D3 are D4 are isolating diodes.

This arrangement especially suits a solar panel, because the LED is on constantly only when the battery is *not* being charged. When the battery is being charged, the flashing LED takes far less power from the solar panel, leaving most of the available power to charge the battery.

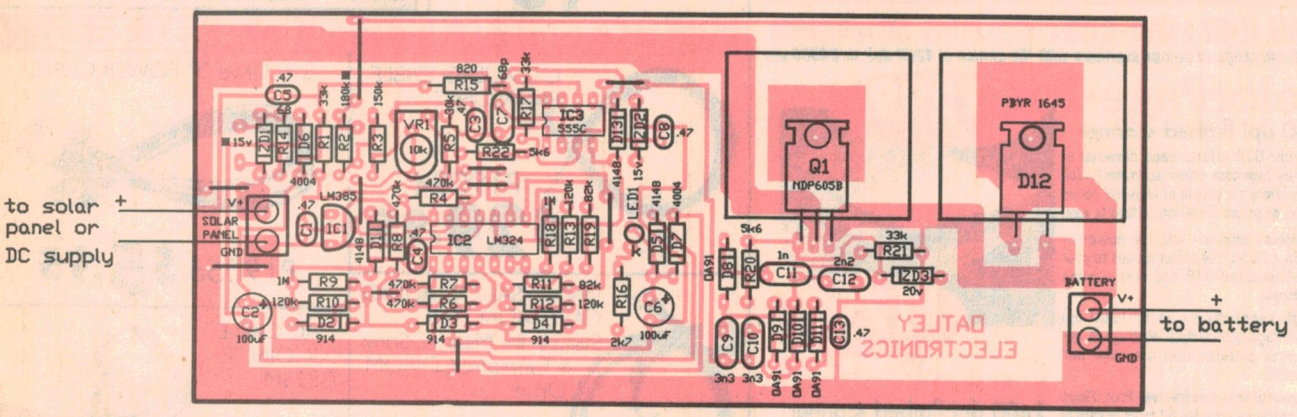


Fig.2: The layout diagram for the board. Fit small heatsinks to Q1 and D12 for charge currents above about 2A. Use a link in place of R2 and ZD1 for 12V battery charging.

Apart from controlling the LED indicator, IC2a also controls the power FET, Q1. Basically, when the output of IC2a is high, the MOSFET is on, when it's low, the MOSFET is off.

When the output of IC2a is high, the voltage at the non-inverting input of Schmitt comparator IC2d is higher than the reference voltage of 2.5V at its inverting input. Therefore the output of IC2d will be high. This enables IC3, which is a CMOS version of the 555 timer, wired as an oscillator. It is this chip that produces the AC input to the voltage multiplier that switches on the MOSFET Q1.

As explained later, this assumes the output of the solar panel (or the DC supply source) is sufficient to give a supply voltage to the circuit above 6V.

If the output voltage of IC2a is low, which occurs when the battery is charged, the output of IC2d is also low, holding IC3 in a reset condition and preventing it from oscillating.

The 200kHz oscillator

A 555C is used for the MOSFET drive oscillator as it needs a supply current of only a few hundred microamps and can operate at high frequencies with high impedance timing components. The rather unconventional astable circuit uses minimum current through the timing components, and gives an exact 50% duty cycle. The frequency is about 200kHz.

The supply voltage to IC3 is limited to 15V by ZD2. Without ZD2, this voltage will virtually equal the voltage from the solar panel (or the DC supply source), which when unloaded could be 20V or more.

Although ZD2 will take current from the DC source, this will only occur when it's disconnected from the battery by the regulator. So for a solar panel, current is taken by ZD2 only when the panel is unloaded...

Voltage multiplier

The output of IC3 connects to a two-stage voltage multiplier which gives a DC voltage between gate and source of the MOSFET of (theoretically) up to twice the peak to peak voltage at the output of IC3. Germanium diodes are used in the voltage multiplier as these give a much lower voltage drop than silicon diodes, particularly at a low current. ZD3 protects the MOSFET against overvoltage between its gate and source.

The high frequency output of IC3 (200kHz) is needed to give short accumulate and decay times for the voltage developed by the voltage multiplier.

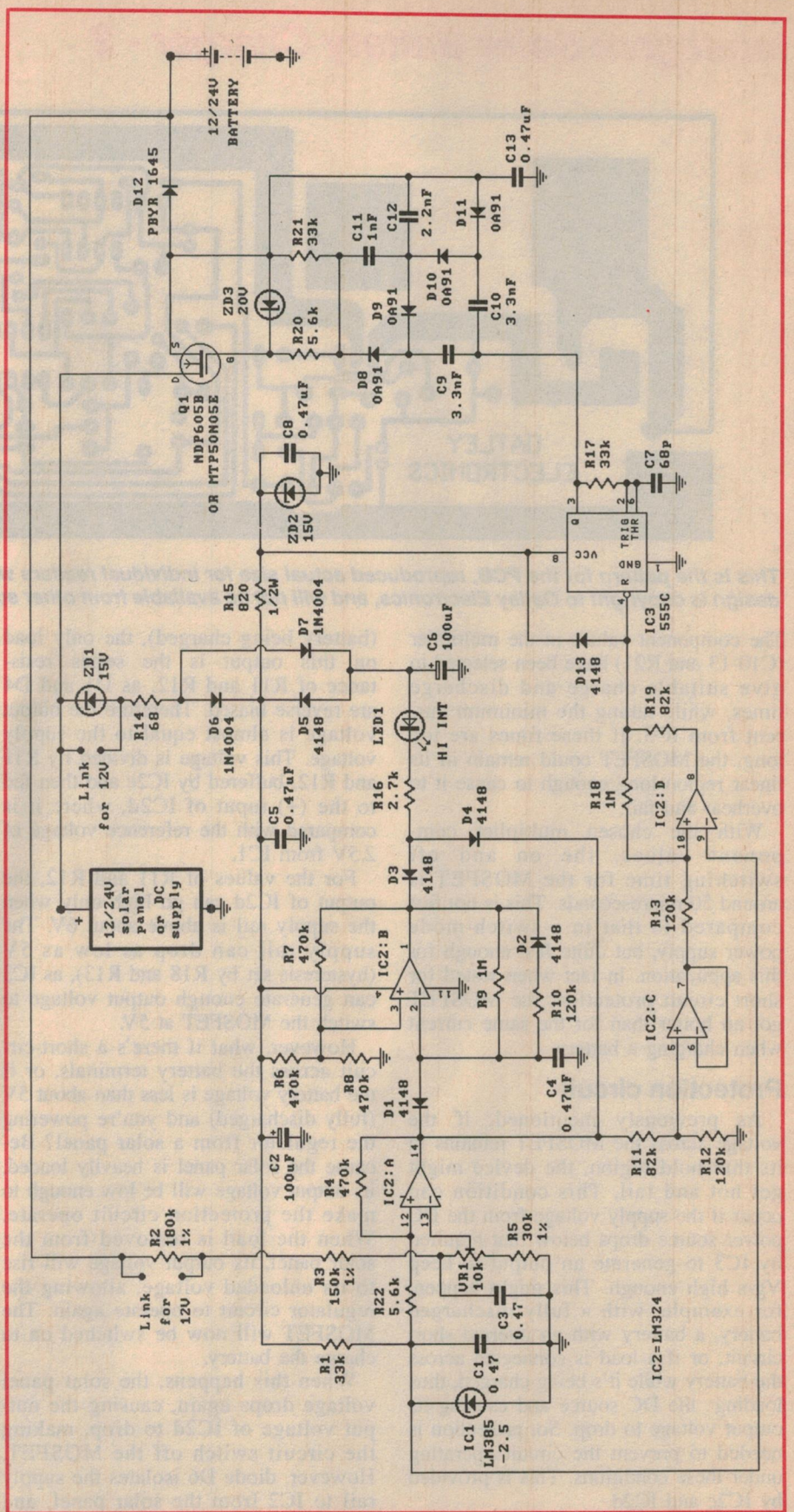
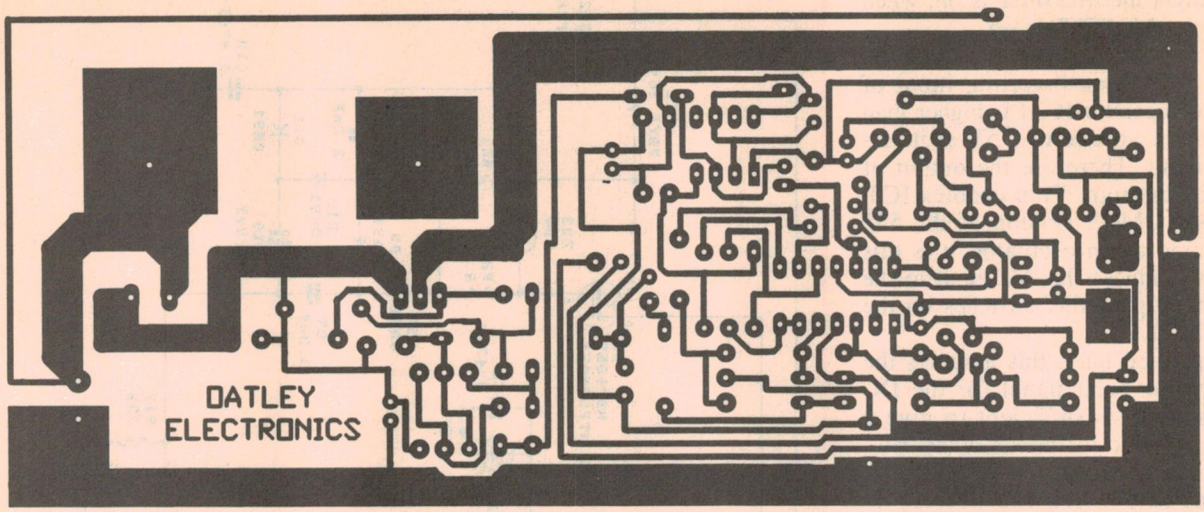


Fig.1: Current to the battery is switched by MOSFET Q1, which is switched by the voltage multiplier of D8-11 — in turn driven by the 200kHz oscillator of IC3. The oscillator runs when the battery terminal voltage is less than a preset value.

Intelligent Solar Battery Charger - 2



This is the pattern for the PCB, reproduced actual size for individual readers who want to make their own. However the design is copyright to Oatley Electronics, and will not be available from other suppliers.

The component values in the multiplier (C10-13 and R21) have been selected to give suitable charge and discharge times, while taking the minimum current from IC3. If these times are too long, the MOSFET could remain in its linear region long enough to cause it to overheat and fail.

With the chosen multiplier component values, the on and off switching time for the MOSFET is around 50 microseconds. This is not fast compared to that in a switch-mode power supply, but quite fast enough for this application. In fact when tested for short circuit protection, the MOSFET got no hotter than for the same current when charging a battery.

Protection circuit

As previously mentioned, if the voltage across the MOSFET remains in its threshold region, the device might get hot and fail. This condition can occur if the supply voltage from the DC power source drops below that required by IC3 to generate an output to keep Vg-s high enough. This might happen, for example, with a fully discharged battery, a battery with an internal short circuit, or if a load is connected across the battery while it's being charged, thus loading the DC source and causing its output voltage to drop. So, protection is needed to prevent the circuit operating under these conditions. This is provided by IC2c and IC2d.

As with most MOSFETs, the device used in this circuit needs a gate-source voltage of about 7V to be fully on. When the output of IC2a is high (battery being charged), the only load on this output is the series resistance of R11 and R12, as D1 and D4 are reverse biased. Therefore the output voltage is almost equal to the supply voltage. This voltage is divided by R11 and R12, buffered by IC2c and then fed to the (+) input of IC2d, where it is compared with the reference voltage of 2.5V from IC1.

For the values of R11 and R12, the output of IC2d can go high only when the supply rail is above about 6V. The supply rail can drop as low as 5V (hysteresis set by R18 and R13), as IC3 can generate enough output voltage to switch the MOSFET at 5V.

However, what if there's a short-circuit across the battery terminals, or if the battery voltage is less than about 5V (fully discharged) and you're powering the regulator from a solar panel? Because the solar panel is heavily loaded, its output voltage will be low enough to make the protection circuit operate. When the load is removed from the solar panel, its output voltage will rise to its unloaded voltage, allowing the regulator circuit to operate again. The MOSFET will now be switched on to charge the battery.

When this happens, the solar panel voltage drops again, causing the output voltage of IC2d to drop, making the circuit switch off the MOSFET. However, diode D6 isolates the supply rail to IC2 from the solar panel, and the charge on C2 keeps the circuit going for a short time.

Eventually C2 is discharged, and the protection circuit operates to switch off the MOSFET, allowing the output of the solar panel to rise to its unloaded voltage. C2 then starts charging, and when the supply rail reaches about 6V, the MOSFET is switched on again. So in effect, another protection circuit is created in the form of a Schmitt trigger oscillator with timing determined by the values of the decoupling capacitor C2, resistor R14 and the current consumption of the circuit.

Under these conditions, the switch-on time of the MOSFET is typically about 30 milliseconds, with a considerably shorter switch-off time. This switch-on time is sufficient to charge C8 through R15, giving IC3 enough supply voltage.

Thus a completely discharged battery is charged at a low duty cycle. By keeping the MOSFET switching frequency low, the number of on-off transitions per second is low, so heat dissipation in the MOSFET is also low.

Isolating diode D7 and decoupling capacitor C6 supply power to the LED, so its current doesn't add to the supply rail current. D5 is needed to pull down the voltage to the LED when the supply rail voltage is falling. This maintains the correct voltage difference between the output of IC2d and the LED anode.

Construction

The PCB supplied with the kit is silk-screened, with the layout shown on the component side of the board. So construction is really just a matter of stocking the board and soldering the components. Refer also to the layout diagram of Fig.2 and the photo of the board (Fig.3).

As usual, fit the wire links, the resistors and capacitors first. Then solder the semiconductors to the board. Make sure you don't accidentally use a signal diode in place of a power diode. If the regulator is being used with a 12V battery, use wire links in place of ZD1 and R2. The heatsinks shown in the photo of Fig.3 are suitable for a charge current up to about 10A.

Testing

The only adjustment on the PCB is VR1, which sets the upper voltage limit of the battery, which for a 12V battery is 14.2V. That is, when the battery voltage reaches 14.2V, the regulator should shut off charge current to the battery. The hysteresis of the circuit lets this voltage fall to around 13.7V before charging starts again.

The simplest way to do this adjustment is to first set VR1 to its mid-position, then connect the regulator to a DC source of around 16V. Connect the regulator to a 12V battery, and monitor the battery voltage with a voltmeter. If you can, monitor the battery charge current with an ammeter. Otherwise, watch the LED indicator, where flashing means charging is taking place, and continuous glowing means no charging.

Then, while the battery is charging, adjust VR1 so the regulator switches the charge current off when the battery voltage is 14.2V. Because the battery voltage will quickly fall to 13.7V, the regulator will cycle on and off, and eventually you'll be able to observe the voltage window of the regulator. Moving VR1 clockwise reduces the upper threshold value. This setting needs to be done carefully, but is really quite easy to do. For a 24V system, make sure you've included ZD1 and R2 on the PCB. The upper threshold battery voltage is now 28.4V, and adjustment is as already described.

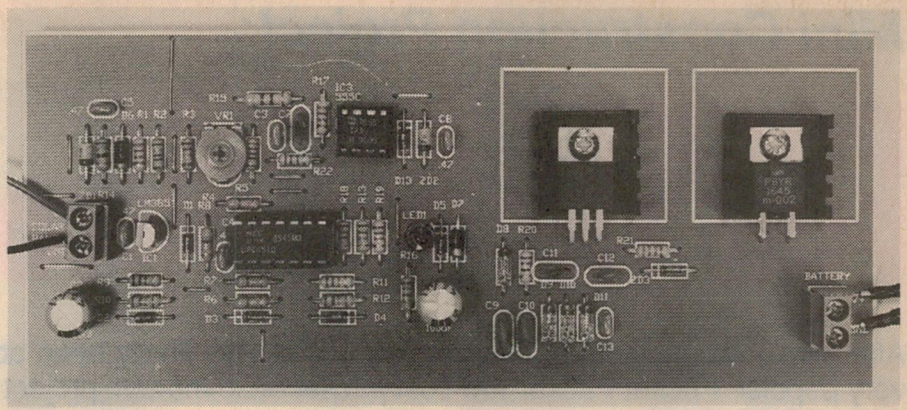


Fig.3: Here's a close up view of the prototype. As you can see, construction is very straightforward. These heatsinks are all you need for currents up to about 10A.

Using the regulator

You have the choice of powering this regulator from either a solar panel or a DC source. The size of solar panel you use is up to your budget, but should be rated at 12V. A 10W panel is ideal, as it won't cost the earth and can provide nearly an ampere of charge current. Connect two 12V panels in series for a 24V charging system. Panels can be directly connected in parallel to give a higher charge current.

There are two things you have to do with a new solar panel: connect leads to the panel and seal it against moisture. How this is done was described in detail in part 1, but briefly, the leads are connected with clips, and the panel is sealed by placing it on a sheet of glass cut slightly larger than the panel, then running a bead of silicone glue to hold the panel onto the glass. This is done after the clips are connected, of course.

To use the regulator as a conventional battery charger, connect it to a DC source of around 16V (loaded voltage). A simple full-wave rectifier with a filter capacitor of 1000uF or so will be suitable. Make sure the DC source can supply at least several amperes if you are charging a car battery. For a gelcell, one amp is enough.

Remember that this regulator has no inherent current limiting. Therefore if your DC source can deliver a high surge current, connect some resistance in series with the DC source and the regulator. This will help protect the MOSFET and the Schottky diode, particularly at power on. The resistance value doesn't need to be very high, probably less than one ohm.

If you already have a basic 2A to 5A battery charger, connect this regulator in series with the charger and the battery. The internal resistance of the charger will limit the current, and the regulator will protect the battery from overcharging.

You should find the heatsinks for the MOSFET and the Schottky diode barely get warm during charging, unless the regulator is passing a high charging current. In this case, fit larger heatsinks. Otherwise, once adjusted properly, you should be able to 'connect, charge and forget'. ❖

PARTS LIST

Resistors

All 1/4W, 5% unless otherwise stated:

R1,17,21	33k
R2	180k 1% (see text)
R3	150k 1%
R4,6-8	470k
R5	30k 1%
R9,18	1M
R10,12,13	120k
R11,19	82k
R14	68 ohm
R15	820 ohm, 0.5W
R16	2.7k
R20,22	5.6k
VR1	10k trimpot

Capacitors

C1,3-5,8,13	0.47uF monolithic
C2,6	100uF 25V electrolytic
C7	68pF ceramic
C9,10	3.3nF ceramic
C11	1nF ceramic
C12	2.2nF ceramic

Semiconductors

Q1	NDP605 or MTP50N05E MOSFET
D1-5,13	1N4148 signal diode
D6,7	1N4004 1A diode
D8-11	OA91 germanium diode
D12	PBYR 1645 16A Schottky diode
ZD1,2	15V 400mW zener diode
ZD3	20V 400mW zener diode
LED1	5mm, red high-intensity LED
IC1	LM385-2.5 voltage reference
IC2	LM324 quad op amp
IC3	555C CMOS timer

Miscellaneous

PCB 65mm x 160mm; 2 x small heatsinks; 14-pin and 8- pin IC sockets (optional); 2 x 2-way PCB mount terminal blocks; hook-up wire.

Kits of parts for this project are available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985
Fax (02) 579 3955
Postal address (mail orders):
PO Box 89, Oatley West NSW 2223.

Battery charger regulator PCB and all on-board components $27
12V 2.5W solar panel $20, or four for $60, giving a 10W system.
PCB and all on-board components for the revised solar charger $13
6V 1.6W solar panel to suit revised solar charger $11
P&P $6

The PCB artwork for the project is copyright to Oatley Electronics.

Mini Construction Project:

POCKET PACKET FOR THE MACINTOSH

After many requests from readers, Tom Moffat has finally been able to work out a way of using his very popular 'Pocket Packet' low cost packet radio modem project with Apple Macintosh computers. Here are the details...

by TOM MOFFAT, VK7TM

"When are you going to do it for the Mac?" That's what all these callers keep asking. So now it's been done: the popular Pocket Packet radio modem project (*Electronics Australia*, November 1992 and January 1993) now runs on the Macintosh computer.

In fact the Mac version does much more than the original IBM-PC version; as well as traditional AX.25 packet radio, it runs the TCP/IP (Transmission Control Protocol/Internet Protocol), which seems to be taking over amateur packet radio in a big way. And a spin-off from the Mac development is that the IBM-PC version of Pocket Packet can now run TCP/IP as well, with software almost identical to the Mac's.

A major article on the whole TCP/IP scene is planned in the next couple of months, so we won't go into much detail here. Suffice it to say that a fully-configured amateur TCP/IP station looks and works almost exactly like a proper Internet site, complete with goodies like electronic mail and 'FTP' file downloading and uploading. In this article we will concentrate on what has to be done to make the Pocket Packet modem kit run on a Mac.

Interface clash

The original Pocket Packet was designed to connect to an RS-232 serial interface, a fairly old system which is still used on the IBM-PC and most other personal computers. But the Mac is a whole different kettle of fish. It uses a newer system, called RS-422.

The biggest difference is that the original RS-232 system uses signal lines working against ground — what's known as 'polar' transmission, in which the signal swings both positive and negative in respect to zero volts. But each signal line is still one wire, unbalanced.

RS-422 is a 'balanced' system in which two wires are used for each signal, operating differentially. One line goes positive while the other goes negative, with the nett result that the two of them added together always equal zero volts.

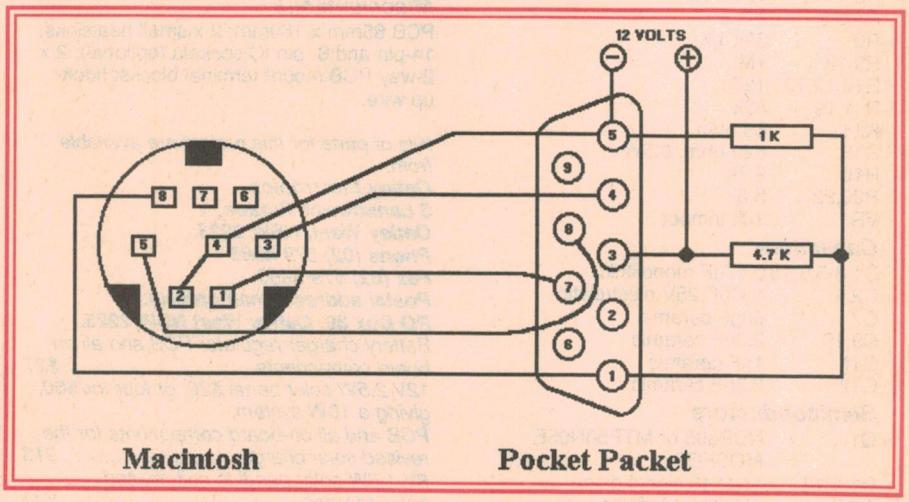
The differential system has a big advantage where long lines are involved, where high-speed data is being sent, and where the circuit is operating in a noisy environment. The only problem is that RS-422 is totally incompatible with RS-232, although this can be overcome with some hardware design. One result is the Macintosh/Pocket Packet interface described herein.

The Mac uses a mini-8 pin DIN connector instead of the DB9 or DB25 that PC people are accustomed to. The mini-8 carries a differential pair of output (transmit) lines on pins 3 and 6, a differential pair of receive lines on pins 5 and 8, and some single-ended handshake lines including an output on pin 1 which carries the DTR (Data Terminal Ready) function. The Pocket Packet modem uses the standard DB9 connector for RS-232.

Transmit data for the Pocket Packet comes from pin 3 of the Mac connector. This is the negative-going half of the differential pair; the positive-going mirror image is simply ignored. As for receiving, things are a little more complicated, because the Macintosh senses only data transitions on the two receive lines relative to each other. But the Pocket Packet output swings back and forth between approximately +4V and 0V.

Resistive network

Simply grounding one of the differential pair and feeding +4V/0V volts into the other won't work, because the data must go truly negative. The solution is a resistive bias network to provide about +2V to one line of the differential pair (Mac pin 8); the



The connections required between the Mac's mini 8-pin DIN connector and the DB9 connector of the Pocket Packet modem. The two resistors are used to adapt the modem's RS-232 interface to the Mac's RS-422 system.

other line (pin 5) then sees the +4V/0V swing as +2V/-2V.

Note that the two resistors come together at pin 1 of the Pocket Packet connector. This doesn't connect to anything internally; it simply serves as a convenient tie-point.

Keying of the radio transmitter is done from the Mac's DTR handshake line (pin 1) mentioned above. When it is sent positive the transmitter switches on. The Pocket Packet has a 'watchdog timer' so that if the DTR line gets stuck for some reason, such as a computer crash, the modem itself will switch off the transmitter after a minute or so.

The Pocket Packet hardware is designed to be powered from the serial port itself, but in the case of the Mac we have decided to employ an external +12V supply such as a plugpack. According to the Macintosh hardware manual, the RS-422 interface can provide a maximum of only 3.6 volts on each line. This just simply isn't enough to run a circuit of five-volt IC's preceded by a voltage regulator.

Such regulators usually drop a minimum of three volts within themselves, and adding that to the 5V output, a raw supply voltage of at least eight volts is required.

This is easily accomplished by the PC's RS-232, but certainly not the Mac. Even if one could develop a perfect rectifier circuit to take advantage of both the positive and negative swings, there would still be a peak of only 7.2 volts.

Kit available

High-Tech Tasmania has now released a special Macintosh version of the Pocket Packet kit, consisting of the original Pocket Packet, a kit of parts for the Mac interface, and a Macintosh disk with AX.25 and TCP/IP packet radio software. It's priced at $99.00 posted in Australia and New Zealand. The IBM-PC version is still available for $89.00 with your choice of 'SP', 'Graphic Packet', or now the combined AX.25-TCP/IP software similar to that on the Mac.

TCP/IP software has the reputation of being a real dog to set up, but the Pocket Packet kits come with the software pre-configured to get you going immediately so you can access other AX.25 and TCP/IP stations. Once you get more experience you can re-configure the software to bigger and better things; even to a full-blown 'Internet site' if you wish.

High-Tech's address is 39 Pillinger Drive, Fern Tree, Tasmania 7054; phone or fax (002) 39 1391. ❖



READER INFO NO. 18



READER INFO NO. 19

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

MERRY FESTIVE DEALS! FROM JAYCAR

DOLBY SURROUND PRO • LOGIC

SURROUND SOUND KIT

REFER SILICON CHIP MAGAZINE DECEMBER 1994
Jaycar are proud to announce the "KIT OF THE DECADE". An enormous amount of effort has gone into this project by staff at both Jaycar and Silicon Chip. Up until now, if you want Dolby Pro Logic it will cost you at least $500. Now you can have it for less than half that. You will have to assemble the kit though. The kit will give you amazing cinema sound in your home. You will need a Hi Fi VCR or any other source of a stereo soundtrack ie Stereo TV, Laser Disk, Cable or Satellite signal and of course an amplifier for the centre and rear channels.



The kit is approved by Dolby Laboratories (USA), and is the only kit currently available in the world for a Dolby Pro Logic Surround Sound Decoder.

NEW



SHORT FORM KIT
PCB and all on board components including Dolby chips, switches, potentiometers & RCA sockets.
Cat. KC-5175 — **$169.50**

PUT IT IN AN ENCLOSURE KIT
Includes everything to complete the kit - box, punched and screened front panel, punched rear panel with label, torroidal mains transformer, mains switch, mains lead and plug and 4 knobs.
Cat. KC-5176 — **$69.50**

★★ AVAILABLE EARLY DECEMBER BUT PLEASE CHECK FIRST ★★ **TOTAL $239.00**

ANOTHER JAYCAR EXCLUSIVE

ALKALINE BATTERY CHARGER

PROLONG THE USE OF YOUR ALKALINE AND ZINC CARBON BATTERIES WITH THIS CHARGER



This NEW "OMEGA" intelli - charger will charge alkaline, nickel cadmium, zinc carbon and alkaline manganese batteries in sizes AA, AAA, C and D.

SAVE MONEY BY RECHARGING INSTEAD OF THROWING AWAY!!!

Up until now, these new generation chargers have cost around $90. We feel that this high price makes the proposition quite marginal. It will take a long time to recoup the cost of the charger because its so high.

ALL THAT HAS CHANGED WITH THIS UNIT!!!

The "Omega" has a built in microprocessor which monitors the charging of each battery. Three different coloured LEDs advise you if: •The battery is charging normally •The charger has rejected the battery, or the battery is reversed •The battery is charged and ready to use

There is no chance of overcharging the batteries, as the unit automatically shuts down each battery compartment when its battery is charged.

Please note: Batteries should not be totally discharged before recharging.

DON'T PAY $90.....OUR IS ONLY $39.95

AC adaptor is extra - unit requires 9VDC at 800mA. Use your existing one, or purchase one separately...Cat MP3008 $22.95

Cat. MB-3525 **Only $39.95**

••••••PROFESSIONAL QUALITY REFERENCE SERIES RCA LEADS AND PLUGS•••••••

If you want the **VERY BEST** quality in RCA audio leads for car Hi Fi, or Home Hi Fi - look no further. These REFERENCE SERIES leads use OFC double shielded low capacitance cable with a central lead wire for remote switching of car amps, or for extra grounding on Home Hi Fi. Cable is figure 8 OFC blue colur with OD of 5mm per side. Plugs are superb quality gold with nickel metal covers - colour coded red/black.



AVAIL. DECEMBER PLEASE CHECK

LEADS - 2 X RCA TO 2 X RCA

CAT	LENGTH	PRICE
WA-1060	0.5 metres	$19.95
WA-1062	1.5 metres	$24.95
WA-1066	5.0 metres	$34.95

PLUGS (Plugs only with 6mm cable entry)

CAT	COLOUR	PRICE
PP-0230	Red	$4.50
PP-0232	Black	$4.50

INSTALLERS / MANUFACTURERS - CONTACT OUR WHOLESALE DEPT FOR BULK PRICES



GIFT IDEAS FROM JAYCAR

Free Call For Phone Orders 008 022 888

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

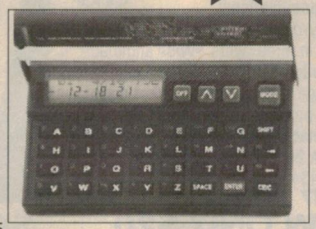
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

DIGITAL DIARIES

Jaycar are proud to introduce a new range of Digital Diary / Databanks. They range from a "The Baby" up to a huge 64K unit with an optional computer interface.

"THE BABY"

NEW



Store 45 names and phone numbers of 15 characters (ie JAYCAR 7435222) on the dot matrix dual-line display. FEATURES: •Time - hour, minute, second •Date - day, month •Year - 200 year calendar •Memo - up to 36 characters •Secret Function - for memo and telephone •Telephone - 45 names / phone numbers each of 15 characters •Calculator - 10 digits •Auto power off •Qwerty keyboard •Individual nice feel buttons •Fold up key cover •Size - 110 x 65 x 9mm

Cat. QM-7300 **Only $15.95**

64K DATABANK NEW

WITH EXTRA WIDE SCREEN AND OPTIONAL COMPUTER INTERFACE.



Features: •Graphic LCD screen with 128 x 40 dot resolution 21 x 5 rows of 5 x 7 dot matrix characters •64k memory for data storage •Databank functions - Telephone directory/Business card library, Memo, Schedule *Entry for each record in either of the above is max 40 rows of characters *Record edit/deletion function *Record / search function: sequential, initial search, name search and date search. •Real time clock with city name, year, month, day of month, day of week, hour, minutes, second in 12 or 24 hour format •Calendar function with full calendar display and search function (year 1901 - 2099) •World time function for 24 cities •12 digit calculator with %, memory & square root •Currency conversion function - 4 present rate •data communication function between two units or through interface to IBM compatible PC. Folds up like a briefcase. Size 130 x 70 x 17mm when folded. **Cat. QM-7320** **Only $129.50**

8K DATABANK - DUAL LINE DISPLAY



This databank will store up to 500 16 character phone numbers, plus a host of other features including: •Time - hour, minute, second, 12 or 24 hour •Date - month, date and day •Alarm - daily •Telephone - 8100 bytes available •Calculator - 12 digit with memory, %, square root, constant, accumulation, and chain calculating functions •Security lock - prevents unauthorised access •Keytone - every function is confirmed by a beep •Dual Line Display •Auto power off Supplied with plastic wallet. Size 103 x 70 x 10mm.

Cat. QM-7305 **Only $27.95**

PC INTERFACE FOR 64K UNIT

NEW



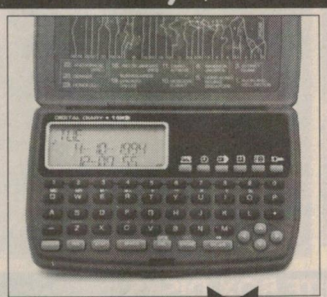
This high performance Interface Kit will provide a fast and convenient communications channel for the transfer of data between the 64k unit and an IBM PC or compatible.

HARDWARE REQUIREMENT

•IBM PC XT/AT (or compatible) with communication port (COM1 or COM 2)
•Monochrome/EGA/VGA monitor with adaptor
•Standard RS232C serial communication port
•Operating voltage (4 x size AA batteries)
•Databank - QM7320

Cat. QM-7324 **Only $39.50**

15K DIGITAL DIARY

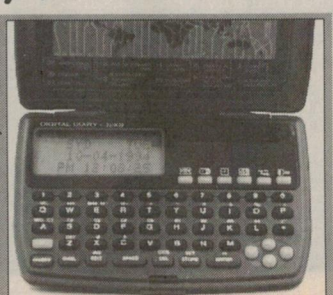


This unit is supplied in a foldup case, like a small briefcase. Size 113 x 80 x 11mm when folded. There is 15,358 bytes of memory and 3 lines of characters showing 12 alpha numerics on each line. Features: •Real time clock - 12 or 24 hour, auto calendar with day, month, year and weekday, daily alarm and keytone •World time clock - for 24 cities representing 24 time zones •Calculator - 10 digits with memory •Schedule keeper alarm •Security code •Databank telephone directory •Message function with maximum of 9 rows (108 characters) can be stored in each file.

NEW

Cat. QM-7310 **Only $47.95**

32K DIGITAL DIARY



Features: •World time - 24 zones with user programmable zone name •12/24 time format - in English or American format •10 digit calculator with % and square root •Accounts manager - memory accomodates up to four accounts, manage deposit and withdrawal of bank accounts, credit card spending etc •Currency convertor - memory accommodates up to five user programmable currency pairs, bidirectional currency conversion •Metric convertor - Bidirectional metric conversion using 11 common pairs including INCH<->CM, YD<->MTR, MIL<->KM, OZ<->G, LB<->KG, TON<->KG, GAL<->LT, CAL<->J, HP<->KW, F°<->C° •Schedule reminders - audible alert signal to inform user of appointments and events. Automatic sorting of reminders in chronological order •Memos - variable length memos to store important names and numbers. Auto sort of these in alphabetical order •Security code •Telephone databank •Supplied in fold up case 110 x 80 x 12mm when folded.

NEW

Cat. QM-7315 **Only $59.95**

BUY 10 - LESS 10%

JAYCAR WATCHES

ALARM CHRONOGRAPH CALCULATOR WATCH

NEW

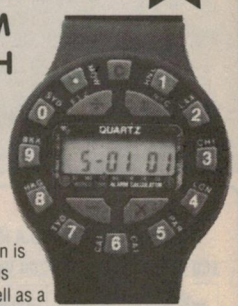


This watch includes the following; •Time - hour, minute, second •Date - month, day •12/24 hour mode •Chronograph in 1/100 second •Alarm •8 digit calculator.

Cat XC-0265 **$12.95**

WORLD TIME, CALCULATOR ALARM WATCH

NEW

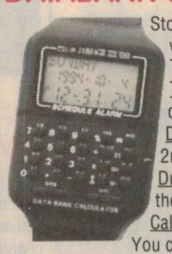


If you travel overseas or phone people you need to know the time there. This function is built into this watch as well as a host of other features. •World time - 12 cities plus 1 free zone •Hour, minute, second, month, date •Day of week •12/24 hour •Alarm •8 digit calculator

Cat. XC-0270 **$14.95**

DATABANK CALCULATOR WATCH

NEW



Store your 50 most used phone numbers on your watch!! Full instructions supplied - even adults can use it! This amazing database watch has the following features

Time •Hour, minute, second displayed on the 3rd line •Year, month, day displayed on the 2nd line •Day of the week on the 1st line

Daily Alarm •Alarm displayed on 1st line •Normal time displayed on the 2nd line •Alarm time displayed on the 3rd line

Dual Time •Time 2 displayed on the 1st line •Normal time displayed on the 2nd line •2nd time displayed on the 3rd line

Calculator 8 digit calculator with memory, % and chain calculator function. You can store a constant (ie fixed currency exchange, measurement etc) which will be kept until you wish to change it.

Telephone Directory Three line databank which will store about 50 names and phone numbers - 1.4k memory - secret lock function. It has three lines •1st line up to 10 alpha characters •2nd line up to 12 numerals •3rd line up to 8 numerals

Schedule Alarm Enter your reminder note and the time/day you wish to be reminded. Ideal for memory jogging.

Cat. XC-0260 **Only $19.95**

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

TECHNOKITS

These new easy to assemble kits are ideal for beginners to learn about electronics. There is **no** soldering required. They make ideal gifts.

NEW



HOME ALARM

Learn the theory and the construction of an alarm.

Cat. KJ-6723 **$14.99**

METAL DETECTOR

Find buried treasure or coins in party games.

Cat. KJ-6722 **$14.99**



NEW

MW IC RADIO

Listen to local radio stations.

Cat. KJ-6721 **$14.99**

CRYSTAL RADIO

Every kid should build a crystal radio.

Cat. KJ-6720 **$14.99**



NEW

AUDIO AMPLIFIER

Amplify the crystal radio or MW radio for all to listen to.

Cat. KJ-6724 **$14.99**



NEW



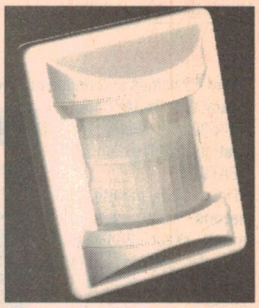
NEW

TURN YOUR SURPLUS STOCK INTO CASH

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout four sources of prime quality merchandise.

Call Mark Harris or Bruce Routley on (02) 743 5222

SAVE A FORTUNE ON BELLMATE 200 PASSIVE INFRA RED DETECTORS



1 YEAR WARRANTY

The manufacturer was overstocked so we have made a special deal - and you save!!! 12 months warranty

Features and Specifications:

•Dual element pyroelectric sensor •24 dual element detection zones in three layers •Wide angle 90° multi layer coverage •12 metre range •Operation voltage 11 - 16V DC •Current draw 20mA •Tamper proof •LED indication •Relay output. N.C. contacts. 22Ω for shorting protection •Max rating 0.5A 24V DC resistive •Colour white •Size 93 x 73 x 43mm

Cat. LA-5017 NORMALLY $34.95

NOW ONLY $20 **SAVE $14.95**

Low Cost Temperature Controlled Soldering Iron



Ideal hobbyist soldering station. It operates on 240 volts, and the transformer delivers a safe 16 volts to the soldering iron.

It has a PTC (Positive Temperature Coefficient) soldering tip at a constant temperature of 310°C which is ideal for PC work. It has a 20 second heatup time.

Replacement Tip Cat TS1202 $9.95

Cat. TS-1200

WAS $49.95

NOW $39.95 **SAVE $10**

TAMPER PROOF TORX SCREW BIT SET

NEW



Finally available at a reasonable price. The set consists of 7 Tamper Proof Star pieces which fit the 6 point STAR type screws with tamper proof pins, as those found on computer systems etc. They are T10, T15, T20, T25, T27, T30, T40. We used to sell the one T20 for $9.95. Now you can buy the whole set for not much more! Made from chrome vanadium - steel and heat treated.

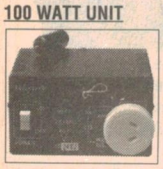
Cat. TD-2034 **A BARGAIN At Only $14.95**

12 VOLT TO 240 VOLT INVERTERS

200W BRAND NEW

CHEAPER PRICES AND A NEW 200W SMALL SIZE UNIT!!!

100 WATT UNIT



Plugs into any cigarette lighter

Cat. MI-5035

Was $134.95

Save $45.45

Now $89.50

200 WATT UNIT



NEW

Super small size Will operate a 200w load all day

Cat. MI-5038

ONLY

$159.50

300 WATT UNIT



Supplied with lead and large alligator clips to connect to battery.

Cat. MI-5040

Was $259.00 Save $59.50

Now Only $199.50

LOWER PRICES LOWER PRICES

WHITE BOX DISKS



Beware of others selling B grade disks. Ours are A grade, and are 100% Certified Error Free with a Lifetime Warranty. Our disks meet 45/20 (ANSI) Clipping Level. •Bulk Users - Contact Our Wholesale Department For Even Better Prices on (02) 743-5222

3.5"	DSDD	Cat XC-4736 $7.50	was $7.95
3.5"	DSHD	Cat XC-4738 $9.50	was $9.95
3.5"	DSHD*	Cat XC-4739 $9.95	was $10.95
5.25"	DSDD	Cat XC-4730 $4.50	
5.25"	DSHD	Cat XC-4732 $7.50	was $7.95
5.25"	DSHD*	Cat XC-4733 $7.95	was $9.50

* denotes "IBM FORMATTED"



SHORTFORM KIT NOW AVAILABLE FOR ACTIVE CROSSOVER FOR SUBWOOFER



REFER EA SEPT 1994 Our full form kit was released last month, and includes case, transformer, mains hardware, new front panel with all inputs and outputs on rear panel instead of the front.

EVERYTHING TO COMPLETE THE KIT

Cat. KA-1764 **$69.95**

SHORT FORM KIT - PCB AND COMPONENTS

Cat. KA-1765 **$29.95**

BUDGET STEREO AMP KIT

NEW



REF: EA 12/94

This stereo amplifier delivers around 15 watts per channel with impressive noise and distortion performance. It is ideal to suit our new Dolby Pro Logic Decoder kit KC5175, small Hi Fi system or home theatre installation. It features CD, TUNER, TV/VCR inputs and bass/treble tone controls. The Jaycar kit is complete with PCBs, transformer, case, punched rear panel and label, punched and screened front panel plus all electronic components.

Cat. KA-1767 **ONLY $129.00**

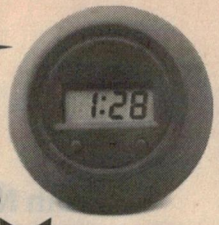
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS
JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS

AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JA

STICK ON TIME

NEW

Need to know the time? In the car, shed, boat, office, kitchen etc, etc, etc. This small round clock also has the date. Supplied with double sided tape. Simply stick it anywhere. Size 40mm dia x 10mm deep. Display height 5.4mm.



Cat. XC-0222 **Only $2.95**

LARGE DIGIT LCD CLOCK

NEW

Huge 19mm display height. It has hour, minute, month, date and second. Overall size 58 x 32 x 11mm.



Cat. XC-0220 **$6.95**

NEW JAYCAR PLUG PACKS

NEW

Two new Jaycar brand plug packs available, both fully Electricity Authority Approved. Both have reversable polarity output plugs supplied. If the plug supplied is not the correct one for you, you can purchase other sizes separately.

CONTACT OUR WHOLESALE DEPARTMENT FOR THE BEST PRICES AROUND

MORE NEW JAYCAR MODELS AVAILABLE SOON



9VDC - 800MA
OUTPUT PLUG 2.1MM DC
Cat. MP-3008 **$22.95**

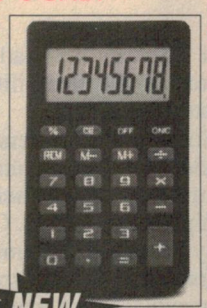
12VAC - 1 AMP
OUTPUT PLUG 2.5MM DC
Cat. MP-3026 **$21.50**

INTERCHANGEABLE PLUGS TO SUIT PLUG PACKS

MINI PLUGS			DC PLUGS		
Cat. PA-3410	2.5mm	$2.00	Cat. PA-3420	2.1mm	$2.00
Cat. PA-3412	3.5mm	$2.00	Cat. PA-3422	2.5mm	$2.00

LARGE DIGIT POCKET CALCULATOR

This calculator has 8 digits and comes in its own plastic wallet. Total size is 100(H) x 60(W) x 10(D)mm. Display height is 13mm. Includes memory and %. Ideal for pockets, briefcases, handbags, desks etc.



Cat. QM-7265
$7.95

NEW

NEW GENERATION NI-MH AA 1.2AH RECHARGEABLE BATTERIES

NEW



NOW WITH SOLDER LUGS

NI-MH batteries have the following advantages over Nicads: •Higher current capacity •Flat discharge curve •No memory effect •High drain performance

With Solder Tags
Cat. SB-2457 **$7.95ea**

Without Solder Tags
Cat. SB-2455 **$7.50ea**

JAYCAR WHOLESALE
PHONE: (02) 743-5222

NEW TOROIDALS & LOWER PRICES

NEW

•Bulk users, contact our Wholesale Dept for special prices.
•20VA range - low profile 30mm (H) x 74mm (Dia)

NEW 20VA RANGE

Voltage:	Cat:
7.5v + 7.5v	MT-2080
9v + 9v	MT-2082
12v + 12v	MT-2084
15v + 15v	MT-2086

Only $24.95 ea

160VA REDUCED

Voltage:	Cat:
12v + 12v	MT-2112
18v + 18v	MT-2113
25v + 25v	MT-2114
30v + 30v	MT-2115
35v + 35v	MT-2116

Only $49.95 ea
Were $66.50 each
Save $16.55

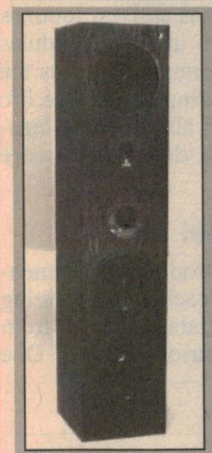
300VA REDUCED

Voltage:	Cat:
12v + 12v	MT-2130
18v + 18v	MT-2132
25v + 25v	MT-2134
30v + 30v	MT-2136
35v + 35v	MT-2138
40v + 40v	MT-2140
45v + 45v	MT-2142

Only $64.95 ea
Were $79.95 each
Save $15



DUKE SPEAKER KITS



Refer Electronics Australia Oct 1994
JAYCAR ARE PROUD TO ANNOUNCE THE RELEASE OF DUKE SPEAKER KITS
There are two speaker kits, the DUKE DK11 pictured on the right has a 6" bass driver and a dome tweeter. The larger kit is the DK77 which is a three way system utilizing 2 x 6" woofers, and a dome midrange and dome tweeter. Call into any Jaycar store for an audition.

"Duke Speaker Kits are very easy to assemble, and will cost you far less than fully-built systems offering equivalent performance" Quote from Electronics Australia

NEW



DK77 Kit
Speakers/crossovers - pair
Cat. CS-2530 **$399**
Cabinets - built - pair
Cat. CS-2532 **$290**
Total $689 pair

DK11 Kit
Speakers/crossovers - pair
Cat. CS-2520 **$229**
Cabinets - built - pair
Cat. CS-2522 **$170**
Total $399 pair



Jaycar ELECTRONICS

HEAD OFFICE	WHOLESALE	MAIL ORDERS	MAIL ORDER - PHONE
6 LEEDS ST RHODES 2138	PHONE: (02) 743 5222	PO BOX 185 CONCORD 2137	FREE CALL - ORDERS ONLY
PHONE: (02) 743 5222	ORDERS: 1800 620 169	ROAD FREIGHT ANYWHERE	(008) 022 888
FAX: (02) 743 2066	FAX: (02) 743 3070	IN AUST (up to 20kg) $14.00	HOTLINE (02) 743 6144

POST & PACKING

$10 - $24.99	$ 3.75
$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
OVER $100	$ 8.00

MasterCard
AMERICAN EXPRESS Cards Welcome
VISA

ADELAIDE SA •194 Wright St (Cnr. Selby St) •Ph:(08) 231 7355 •Fax:(08) 231 7314 •Mon/Fri:9-5.30 •Fri:8.30 •Sat:9-12pm

BURANDA QLD •144 Logan Rd •Ph:(07) 393 0777 •Fax:(07) 393 0045 •Mon/Fri:9-5.30 •Thurs:8.30 •Sat:9-4pm

CANBERRA ACT •11 Kembla St. Fyshwick •Ph:(06) 239 1801 •Fax:(06) 239 1821 •Mon/Fri:9-5.30 •Sat:9-1pm

COBURG VIC •266 Sydney Rd •Ph:(03) 384 1811 •Fax:(03) 384 0061 •Mon/Fri:9-5.30 •Fri:8.30 •Sat:9-4pm

MELBOURNE CITY •Shop 2, 45 A'Beckett St •Ph:(03) 663 2030 •Fax:663 1198 •Mon/Fri:9-5.30 •Fri:8.30 •Sat:9-2 •Sun:10-4pm

SPRINGVALE VIC •887-889 Springvale Rd Mulgrave. Nr Cnr. Dandenong Rd •Ph:(03) 547 1022 •Fax:(03) 547 1046 •Mon/Fri:9-5.30 •Fri:8.30 •Sat:9-4pm

SYDNEY CITY •129 York St •Ph:(02) 267 1614 •Fax:(02) 267 1951 •Mon/Fri:8.30-5.30 •Thurs:8.30pm •Sat:9-4pm

BANKSTOWN •363 Hume Hwy Cnr Meredith St •Ph:(02) 709 2822 •Fax:(02)709 2007 •Mon/Fri:9-5.30 •Thurs:8.30pm •Sat:9-4 •Sun:10-4pm

GORE HILL •188 Pacific Hwy (Cnr. Bellevue Ave) •Ph:(02) 439 4799 •Fax:(02) 439 4895 •Mon/Fri:9-5.30 •Thurs:8.30 •Sat:9-4 •Sun:10-4

PARRAMATTA •355 Church St (Cnr. Victoria Rd) •Ph:(02) 683 3377 •Fax:(02) 683 3628 •Mon/Fri:9-5.30 •Thurs:8.30pm •Sat:9-4pm •Sun:10am-4pm

PENRITH •199 High St •Ph:(047) 21 8337 •Fax:(047) 21 8935 •Mon/Fri:9-5.30 •Thurs:8.30 •Sat:9-4pm •Sun:10-4pm

RHODES •6 Leeds St •Ph:(02) 743 5222 •Fax:(02) 743 2066 •Mon/Fri:9-5.30

AYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS JAYCAR ELECTRONICS J

AUTOMOTIVE ELECTRONICS



with NICK DE VRIES MIAME, AMSAE

The PC revolution in engine analysers

Without a doubt, the most important recent development in engine fault diagnosis has been the PC-based analyser. This month, we look at the many advantages of this type of analyser, and why it represents the future for this technology.

In May this year, at the Automotive Trade Fair in Sydney's Royal Agricultural Showground, I counted no less than six PC-based engine analysers — with at least four others not in attendance. The proliferation of component suppliers offering ready built 'plug and play' cards for data acquisition and serial communications have made the IBM-compatible personal computer a very versatile platform from which to launch a relatively low cost development program.

Without the need to develop their own operating systems and basic hardware, the combatants in the fight for supremacy have only to concentrate on the interface cards and probes between the Vehicle Under Test (VUT?) and the PC — which for this kind of work is usually housed in a more suitable steel cabinet.

Interestingly, there have been quite a few different approaches to the problem of how best to capture and display engine data for analysis by the automotive diagnostician. Until fairly recent times, motor mechanics and auto electricians were accustomed to viewing the electrical system of the motor car with various types of purpose-built meters and oscilloscopes, often housed together in one large console. Typically this 'Tunescope' had the engine probes (usually battery, coil primary, number-1 cylinder probe, and kV probe) acting directly onto the guns of the CRT — via some signal conditioning hardware — to display the approximate ignition voltages in the appropriate order, instantaneously as they happened.

Fully digital systems without any type of oscilloscope display also had a brief appearance, but seem to have disappeared from the market. Whilst these variants offered a simpler format by not presenting the waveforms at all, but rather a set of peak voltages or graphs, most technicians wanted to see what else was going on behind the scenes.

The inexorable march of technology has introduced extra parameters such as electronic fuel injection, ignition, and braking systems. The Tunescope of today is expected to provide these extra diagnostic capabilities, which equipment just 10 years ago had neither the hardware nor the flexibility to display adequately — if at all.

Some manufacturers have offered upgrade kits, at astronomical cost, in an attempt to keep their 'Jurassic era' equipment up to date. Generally these still only managed incremental advances or, worse still, 'vehicle specific' adaptors. It is unavoidable of course, given the evolutionary nature of the motor car's history, that updates will become necessary.

The use of PC-based equipment however, means that software can be changed, new programs and test routines added, and hardware upgrade modules can be kept to a minimum. This has the dual benefit of extending the service life of the equipment and also keeping business operating costs down to a more manageable level.

Serial vs parallel

Earlier in my introduction, I mentioned different approaches to capturing and displaying the data obtained from the engine by the various probes. One

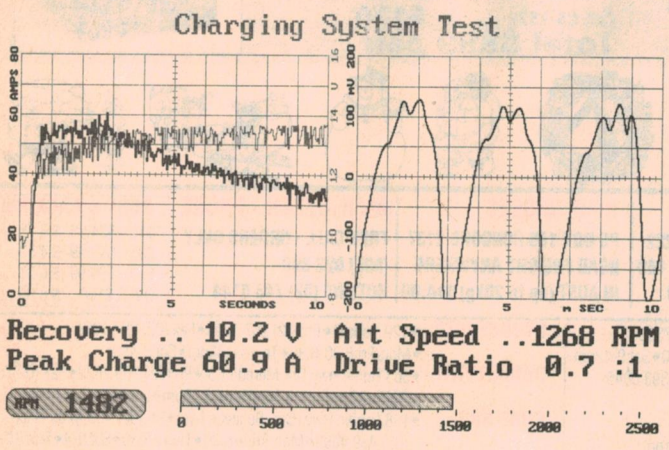


Fig.1: Checked using the ADS9000 PC-based analyser, the author's VL Commodore shows the beginnings of an alternator problem. There's still plenty of output, but one phase is starting to deteriorate...

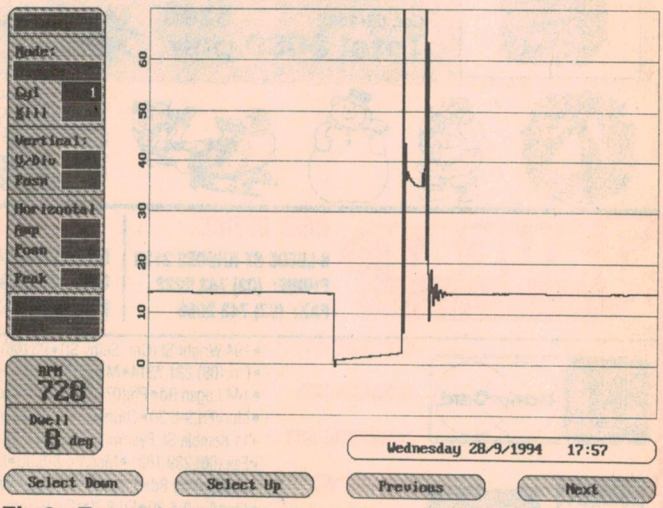


Fig.2: Expanded trace of the No.1 cylinder primary coil current, showing the 'dwell' period and firing spike with oscillations. Note the rpm and dwell data at lower left.

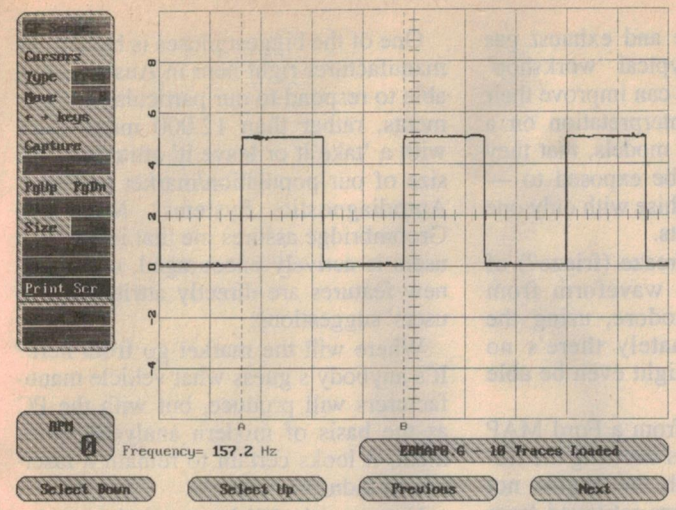


Fig.3: Only just within the +/-3Hz specification, this Ford MAP sensor output influences the quantity of fuel injected into the engine.

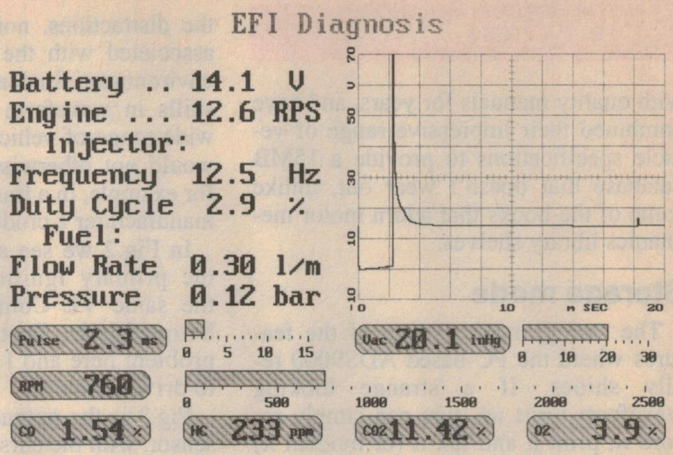


Fig.4: How much diagnostic power do you need? A 'real time' scope display showing the injector signal plus thirteen additional digital readings, plus three bar graphs providing a comprehensive summary of the EFI system's operation.

school of thought would have us believe that it is OK to use the serial port of the PC, and pump the data in as a signal stream at high speed.

Almost all of the PC-based analysers to date have used this serial port method. Consequently, the transition away from analog to digital has not been rushed. This method seems to work really well if you can keep the engine idling at about 300rpm!

As the engine rpm rises above starter motor cranking speed, the trace on the 'oscilloscope' displays a series of snapshots, while leaving large chunks of data (about 98%) undisplayed and ostensibly, irretrievable. This means that the serial technique has the potential to 'miss out' on the very aberrations that the technician is looking for.

The ADS9000

A second, and far superior system forms the basis of this discussion. Developed by Sydney-based Autodiagnostic Systems, the ADS9000 uses a process that feeds all the channels to be measured through a fast peak detection circuit, directly into the PC bus.

Through careful matching of hardware with hundreds of hours of software refinement, the result is a real-time oscilloscope offering five customised setups — namely, Primary and Secondary Ignition; EFI; Alternator Ripple; Vacuum Trace; and a general purpose dual trace 'scope with a timebase ranging from 0.1ms per division to 0.5 seconds per division!

This unusual flexibility means the technician can view a waveform from any vehicle sensor in real time; use the 'Freeze' function, apply the measuring cursors and resolve such parameters as voltage, time, frequency or degrees of camshaft/distributor rotation. As well as this, a Storage Mode can file away for future reference a paltry 20,000 sets of waveforms, of up to 500 sweeps each, on the hard drive!

You never know when you might get a repeat of the same symptoms in another obscure privately-imported Toyota Soarer, sometime after next Christmas — when you have forgotten what the heck was wrong with this one, this time!

Digital displays

As well as the six oscilloscope formats, the ADS9000 provides a veritable plethora of digital and combination scope/digital displays and tests.

Fig.1 shows a Charging System Test performed on my VL Commodore. Notice the different timebases on each oscilloscope display; the one on the left shows battery voltage and charging current over 10 seconds, whereas the one on the right shows an AC coupled expansion of the rectified three-phase alternator output over 10 milliseconds.

I was somewhat alarmed to discover a fault developing in the alternator, that was superimposing a 430mV noise component (invisible to a multimeter) on the supply line to the whole vehicle's electrical system. I wonder how long the ECU will put up with this, before going bananas?

The future

The future for PC-based equipment has distinct advantages over analog machines. For example there are lots of 'after market' peripherals that can be added to enhance the equipment.

One of the possibilities is the inclusion of a modem with each machine. This has the threefold benefit of enabling the manufacturer to update your software without leaving the office; provide a means of driving the machine from remote locations for customer support and training; and finally should the customer wish to use their equipment as a regular PC to transfer files and information, they have a modem already installed.

Franchised repairers and dealerships will find this very attractive from the viewpoint of sharing information. In the case of the ADS9000, for example, whole swags of stored scope traces can be transferred to another site in a matter of minutes.

CD-ROM manuals

Another future development, already available in the US is repair manuals on CD-ROM, and able to be read via a PC-based analyser. US publisher Mitchell's Manuals now has an extensive range of US domestic vehicle repair manuals available, complete with wiring diagrams, etc. This means that the technician can go to the appropriate model section, zoom in on a part of the schematic, print it out and not have to worry about getting a smudge or two in the crucial spot.

Moves are already afoot to publish a similar database here in Australia. Already available for the PC using the hard drive rather than CD-ROM is Boyce's *Auto Instant Access*, a database of 1600 Australian and imported vehicle models spanning the last 10 years, with specifications on adjustments, fluid levels, emission data, electrical systems, maintenance schedules and diagrams, to name just a few.

David Boyce Publishing of Redfern in NSW has been supplying the industry

with quality manuals for years, and have combined their impressive range of vehicle specifications to provide a 15MB database that doesn't wear out, unlike some of the books that adorn motor mechanics library shelves.

Storage mode

The storage mode is one of the features where the PC-based ADS9000 really shines. If a strange looking waveform turns up, you can simply record it, print it and fax it (or modem it) to the help desk or training officer within your organisation. Alternatively, you can compare it to the database in your own unit or a colleague's unit.

Ultimately, the owner of the VUT benefits by a better diagnosis and speedier repair. The diagnostician also benefits because other highly trained 'heads' are able to look at the scope picture from remote locations, and help by suggesting an alternative course of action. Sounds like a win/win situation, doesn't it?

Various TAFE colleges around the country are using the ADS9000 to good effect by being able to reproduce real vehicle signals in the classroom without the distractions, noise and exhaust gas associated with the typical 'workshop' environment. Students can improve their skills in waveform interpretation on a wide range of vehicle models, that they would not otherwise be exposed to — for example, in a franchise with only one manufacturer's products.

In Fig.2 we see a freeze (frieze?) of the primary ignition waveform from the same VL Commodore, using the Scope Mode. Fortunately there's no problem here and I might even be able to drive it home!

Fig.3 is the output from a Ford MAP sensor, with the cursors showing the frequency measured with the engine not running, with 10 sweeps retrieved from the hard drive in Storage Mode.

Conclusion

That the ADS9000 is aimed squarely at the specialist EFI tuning shop is quite plain. This does not mean, however, that pre-1986 motor cars are 'persona non grata'. Motor vehicles fitted with such arcane devices as contact breaker points are admirably catered for with some very excellent features, such as dynamic and static coil negative and positive measurements, indicating voltage drop and current draw.

One of the biggest pluses is having the manufacturer right here in Australia and able to respond to our particular requirements, rather than 12,000 miles away with a 'take it or leave it' attitude to the size of our population/market potential. Autodiagnostic Systems' MD Bob Groombridge assures me that input from users is actively encouraged, and many new features are directly attributable to users' suggestions.

Where will the market go from here? It's anybody's guess what vehicle manufacturers will produce, but with the PC as the basis of modern analysis equipment, it looks certain to remain a fascinating industry.

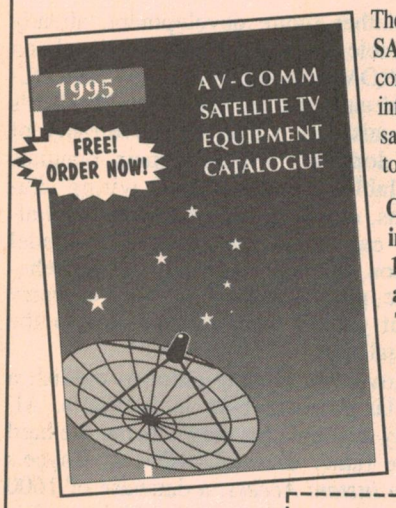
Next month, I'll be presenting an interview with INJEC Racing Developments' Phil Lamovie, tracing the growth of the aftermarket fuel injection scene. Cheers for now! ❖

HI-FI: AN INTRODUCTION

by Neville Williams

After many requests, we've produced an updated version of this very popular guide to choosing the right equipment and setting it up correctly. Look for it at your newsagent now, still priced at only $4.95.

NOT COMING TO A NEWSAGENT NEAR YOU!



The new **1995 AV-COMM SATELLITE TV CATALOGUE**, contains up to the minute information on all available satellites and equipment needed to receive them.

Contains detailed information on over 150 products covering all aspects of Satellite Television Reception.

For your **FREE** copy of the new 1995 AV-COMM CATALOGUE simply complete the coupon below and send to: AV-COMM PTY. LTD. P.O. Box 225, Balgowlah NSW 2093.

Please send me a FREE copy of the 1995 AV-COMM Satellite TV Catalogue.

Name: _____

Address: _____

_____ P'code: _____

Phone: () _____

AV-COMM PTY LTD
A.C.N. 002 174 478
198 Condamine Street,
Balgowlah NSW 2093
Tel: (02) 949 7417/948 2667
Fax: (02) 949 7095

NEW KITS FOR EA PROJECTS

Dick Smith Electronics has advised us of its release of a new kit for the following recent *EA* project:

BUDGET PRICED 'SHOESTRING' STEREO AMPLIFIER (December 1994): The Dick Smith Electronics kit is complete, with all specified components, plastic case, pre-punched and silk-screened aluminium front panel, pre-punched aluminium rear panel and attractive control knobs. The kit has the catalog number K-5610 and is priced at $119.95.

Jaycar Electronics has also advised us of its release of a new kit for a recent EA project:

BUDGET PRICED 'SHOESTRING' STEREO AMPLIFIER (December 1994): The Jaycar Electronics kit is complete, with punched and silk-screened front panel and punched back panel, and includes 1% metal film resistors and MKT capacitors. The kit carries the catalog number KA-1767 and is priced at $129.00.

NOTE: This information is published in good faith, from information supplied by the firm or firms concerned, as a service to our readers. Electronics Australia cannot accept responsibility for errors or omissions.

THANK GOD FOR THE SALVOS

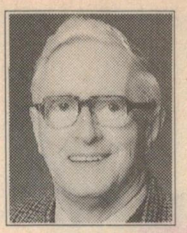
THE SALVATION ARMY

SAL 9840/D

READER INFO NO. 37

SHORTWAVE LISTENING

with
Arthur Cushen, MBE



Difficulties during wartime listening

A reader recently asked me to describe what listening was like 50 years ago, during the War. Well, there was few stations, lower power, smaller bands, censorship and deliberate interference, as the Allies and Axis battled out a radio war that covered the globe.

The mouthpiece of the Allied cause was the BBC General Overseas Service, which was forced to become the focus of news for the listening public worldwide as Britain withstood the German onslaught. The BBC General Overseas Service was in its infancy, but was expanded immediately to cater for this new worldwide audience — and in particular, it began broadcasting in French, Dutch and other languages to those occupied countries of Europe.

Listeners in this part of the world were favoured with a special BBC Pacific Service, which featured news of interest to listeners in this area, and 'Radio Newsreel' — a magazine sound picture which looked at items in detail that were in the focus of news.

In February 1942, the BBC asked me to become their technical monitor, and weekly reports were sent to London. Due to the mail difficulties, these were backed up by international telegrams — over 1000 of which were sent to the BBC during that period and later into the days of peace.

The telegrams consisted of 50 words and in those days, callsigns were used instead of the allocated frequency and a SINPO code used to rate the reception of the broadcasts.

The fall of countries in Europe resulted in the operation of stations in overseas colonies, and France was the first to open transmissions in Brazzaville in the French Congo and across the Congo River. Belgium broadcast from Leopoldville in the Belgian Congo. These transmissions were beamed to Europe to give hope to those in occupied countries.

As well as the BBC broadcasting its own service, there were many stations using BBC transmitters and one of these was ABSIE, standing for American Broadcasting Station in Europe. Britain also used its influence in the Middle East to operate stations from Palestine and Egypt, and across North Africa stations from Algiers and other countries in this area started to be heard on the shortwave bands.

In the South Pacific, Radio Australia was the major voice in this area following the opening at Shepparton in 1939. This was followed by the Voice of America, with transmitters on the west coast of North America and in Hawaii beaming programmes into Asia after the declaration of war by Japan. Japan quickly overran many of the stations we were hearing, such as Shanghai, Manila, Singapore and Batavia — which soon became the voice of the Japanese occupying forces.

Reception reports

One of the difficulties in writing to broadcasting stations during the war years was the censorship of mail. Often mail was received with parts of the letter cut out, letters were stamped by the censor and as all mail travelled by sea, it took up to a year to get a verification from Lourenco Marques Radio in Mozambique when such stations as CR7AA 6137kHz, CR7AB 3490, and from South Africa SABC stations at Pietermaritzburg on 4878kHz and Capetown 5880 were received.

On the other side of Africa, Belgian Congo station OTC and French Congo station Brazzaville also took many months to verify. North and South America were not effected by the war and so broadcasting from those areas was uninhibited and many stations were verified, particularly North American AM broadcasters heard at my city location.

When compiling a reception report, one had to look at the actual station information and not the contents of news broadcasts, because this was generally sensitive information. One of the biggest losses in wartime broadcasting was the ending of weather information as this is always a pointer to the location of a station.

It was interesting to recall that when listening to KFDA in Amerillo, Texas, they confirmed reception with a cutting from the local newspaper. This commented on the fact that I had heard the broadcast in New Zealand and pointed out to the Texas panhandle farmers the reason why weather information was not broadcast. As their signal had no boundaries, it could have been picked up by a Japanese submarine off the Californian coast. ❖

AROUND THE WORLD

AUSTRALIA: The ABC news network which also carries Parliamentary broadcasts is relayed from the following: Perth 585, Sydney 630, Hobart 729, Brisbane 936, Melbourne 1026, Canberra 1440, Newcastle 1458kHz. Operation is 24 hours a day.

BHUTAN: Thimpu is heard on 5025kHz with English 1415 - 1500 broadcast from high in the Himalayas and programmes are mainly of spoken features.

BOUGAINVILLE: Now on 3875kHz to sign off at 1300UTC. Programmes are of English pop music and Island music, with announcements in Pidgin. The station gives times the same as Papua New Guinea and closes with the PNG National Anthem. Peace has been declared after six years of war and a Peace Keepers Force from Tonga, Fiji and Vanuatu are to move into the area.

ISRAEL: Transmissions have been retimed and the best two broadcasts in this area are 0500 - 0515 on 7465, 9435 and 17,545kHz and 2000 - 2030 on 7405, 7465, 9435, 11,603 and 17,574kHz and these broadcasts are in English.

KOREA: Radio Korea International is the new slogan, which took effect on the occasion of the 41st birthday and opening of a new 250kW transmitter. The English broadcasts are relayed by the BBC at 2030 on 5965kHz and by RCI at 1030 on 11,715kHz.

JAPAN: Radio Japan from Tokyo, as well as using its own transmitters with an English broadcast at 0500, is also available on BBC Skelton 5965, 7230kHz; also RCI Sackville 9725, and BBC Singapore 11,740kHz.

PHILIPPINES: A VOA transmitter is used by Radio Liberty in Russian, with sign-on at 2000 on 7230kHz beamed to Siberia, with some interference from Radio Moscow.

THAILAND: Bangkok heard with a 500kW transmitter from Udorn with English to Europe 1900 - 2000 on 9700kHz. Feature programmes include news, comment, finance, sports and education, and at 2000 transmission commences in German. At 1900 and 2000 there is the usual clock chimes and a recorded announcement, giving languages broadcasts in the new External Service.

USA: WWCR Nashville's latest schedule is: Transmitter 1, 1200 - 2400 15,685khz; 2400 - 0800, 7435; 0800 - 1000, 9370; 1000 - 1200, 12,160kHz; Transmitter 2, 0100 - 1400 5935; 1400 - 0100 13,845kHz.

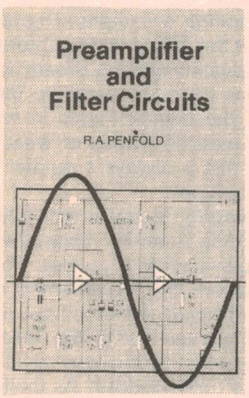
UNITED KINGDOM: BBC World Service to the Pacific has added some new frequencies; 15,350kHz 0500 - 0515; 15,340kHz, 2300 - 2400; and 15,280kHz 0915 - 1015. BBC is relayed by Radio Australia on 11,695kHz 2200 - 2300 and by Radio New Zealand International 9700kHz 1100 - 1130.

YUGOSLAVIA: Belgrade heard well in English at 2100 - 2130 on 7265 and 9595kHz, beamed to Australia. Also operating to Europe on 6100kHz, Africa on 9720kHz, and North America on 9580 and 11,870kHz. Other transmissions announced are at 1830 on 6100 and 9720kHz, 2030 on 9620 and 0403 on 9580, 11,870kHz. ❖

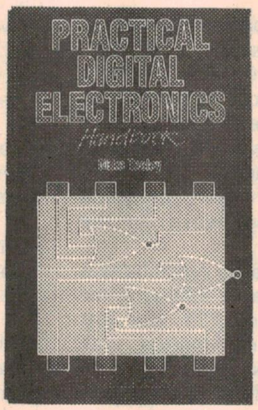
This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 11 hours behind Australian Daylight Time and 13 hours behind NZ Daylight Time.

Electronics Australia

BOOKSHOP



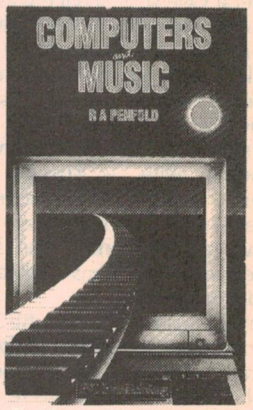
Preamplifier and Filter Circuits
This book provides circuits and background information for a range of preamplifiers, plus time controls, filters and mixers. The circuits described are simple and previous experience of electronic project construction is not needed.
CODE: BP 3090 PRICE: $11.00



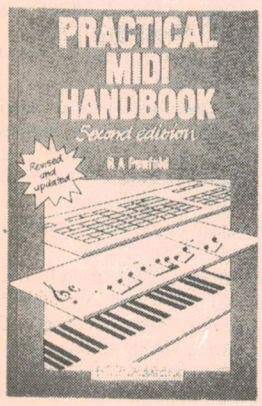
Practical Digitial Electronics Handbook
This book introduces digital circuits, logic gates, bistables and timers as well as microprocessers, memory and input/output devices. It will prove invaluable to anyone involved with the design, manufacture or servicing of digital circuitry.
CODE: PC 1004 PRICE: $22.95



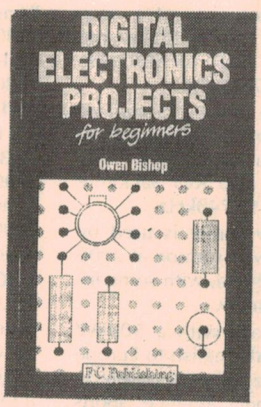
Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
CODE: PC 1007 PRICE: $22.95



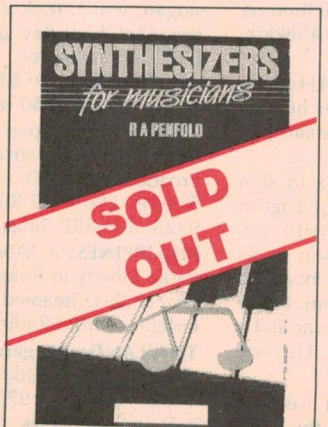
Computers and Music - An Introduction:
This book explains how to simply set up your own computer music studio. It covers the basics of computing, running applications programs, wiring up a MIDI system plus everything about hardware and the programs.
CODE: PC 1006 PRICE: $27.95



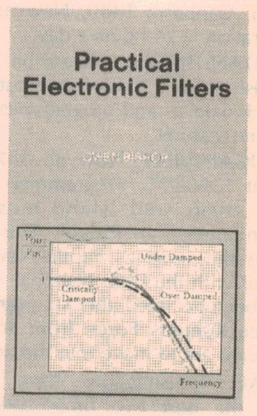
Practical MIDI Handbook
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
CODE: PC 1002 PRICE: $22.95



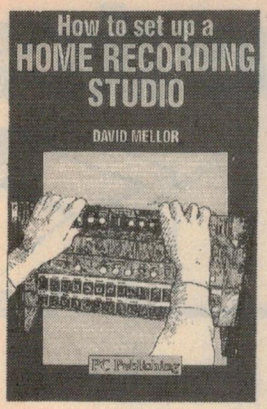
Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
CODE: PC 1011 PRICE: $19.95



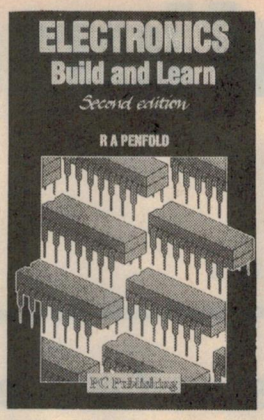
Synthesizers for Musicians
Written especially for musicians, this book explains how to get the best from your synthesizer or sampler. If you want to go beyond using the factory presets or the random poking of buttons, then this is the book for you.
CODE: PC 1003 PRICE: $19.95



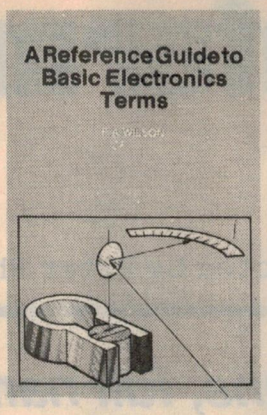
Practical Electronic Filters
Practical Electronic Filters explains in a simple form, the understanding of how to work a filter. It presents projects to apply in and around the home, including diagrams that are suited to the beginner and a more advanced constructor.
CODE: BP 2990 PRICE: $13.00



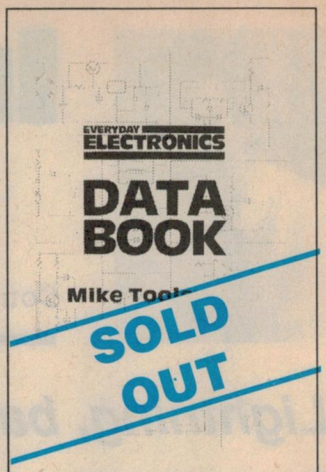
How to set up a home Recording Studio
If you have a studio at home or are about to set one up, this book is for you! It describes the setting up of an 8 to 16 track studio with an outline of the musical and recording gear needed.
CODE: PC 1009 PRICE: $22.95



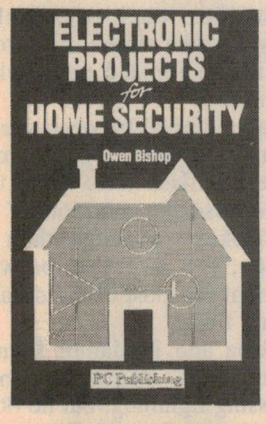
Electronics - Build and Learn
This book is the perfect balance of theory & practice. It introduces common electronic components and how they are built into useful circuits. An essential for the beginner, providing practical tests and experiments.
CODE: PC 1008 PRICE: $19.95



A Reference guide to Basic Electronic Terms
A comprehensive A to Z guide of electronic terms. This book chooses and explains some of the more important fundamental terms (over 700), making the explanations easy to understand and avoiding high level mathematics.
CODE: BP 2860 PRICE: $16.00



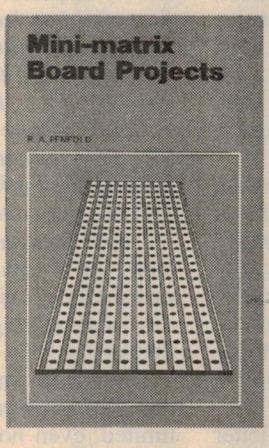
Everyday Electronics Data Book
This book is an invaluable source of information of everyday relevance in the world of electronics. A must for everyone involved on electronics who wants to put theory into practice.
CODE: PC 1012 PRICE: $27.95



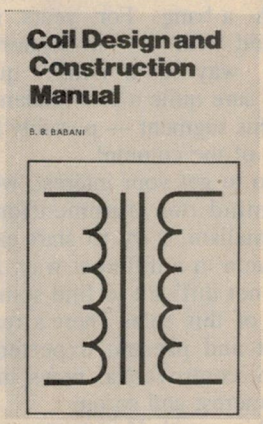
Electronic Projects for Home Security
This book deals with the many aspects of home-security and how to construct your own security system. It covers the latest in technology, whilst remaining simple and reliable in its instruction.
CODE: PC 1010 PRICE: $22.95



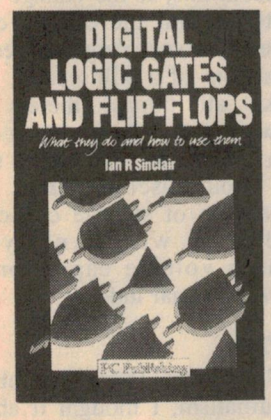
Electronic Power Supply Handbook
This book covers the topic of electronic power supplies, including batteries, simple AC supplies, switch-mode supplies and inverters. Subjects dealt in detail are devices, their operating principles and typical circuits.
CODE: PC 1001 PRICE: $23.95



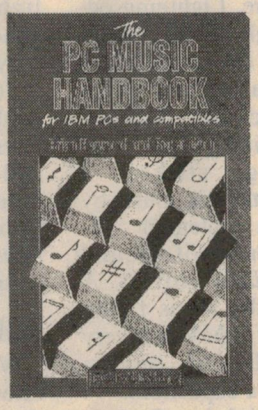
Mini Matrix Board Projects
This book provides you with 20 useful and interesting circuits, all of which can be used on a mini matrix board, which is just 24 holes by 10 copper strips.
CODE: BP 9900 PRICE: $6.50



Coil Design and Construction Manual
A unique book for both the professional and home constructor on 'How to Make' your own R.F., I.F., Audio and Power coils, chokes and transformers etc.
CODE: BP 1600 PRICE: $6.50



Digital Logic Gates and Flip-Flop
Intended for enthusiasts, this book aims to provide a firm understanding of gates and flip-flops thoroughly and from the beginning. It is for the user who wants to know more than a few rules of thumb about digital circuits.
CODE: PC 1013 PRICE: $26.95

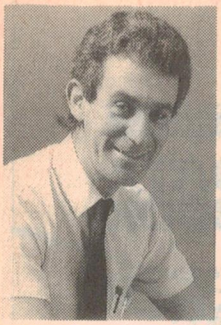


The PC Music Handbook
This book takes the reader through the creative possibilities of the personal computer. Full of practical tips on equipment plus explanation of sequencing, sampling and notation.
CODE: PC 1005 PRICE: $27.95

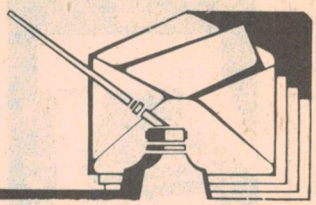
HOW TO ORDER

To order, simply fill in the coupon, remembering to include the code numbers and $5.00 postage and handling. If the coupon is missing, write down the names, code numbers and prices of the books you require. Include your name, address, phone number, plus cheque, money order or credit card details (card type, card number, expiry date and signature) and send it all to Federal Publishing, Reply Paid No. 3, PO Box 199, Alexandria, NSW 2015.

Please allow at least 40 days for delivery, and please sign all orders.



Information centre



Conducted by Peter Phillips

Lightning, baluns, full names and more

This month we depart from a long-standing convention. We also discuss our usual wide ranging issues — including lightning, fuel economy and other automotive matters. There's also a repair story involving a multimeter, and a solution to the September What??

One of the rules of journalism is to, metaphorically speaking, start and end an article (column) with a bang. For years now we've ended with a metaphorical bang by way of a What?? question, and I'm sure quite a few readers go straight to this segment — possibly ignoring the rest of the column!

So to get your interest, while bearing in mind the aforementioned rule of journalism, I try to start each month's column in a different way. And usually it's not difficult to find something worthy of this role. There's reader letters, past and present experiences of my own, controversial news items, points of interest and so on.

This month I'm starting with a letter that offers the 'bang' I'm after. I'm sure you'll find it interesting, perhaps even slightly bizarre. But the writer is earnest in what he says, and keen to proceed with an experiment that has considerable danger and quite a few historical overtones.

HV storage capacitor

Before presenting the letter, I need to point out that the writer contacted me previously, asking where he could buy a high voltage capacitor. I wrote back asking for more information, such as the intended purpose for the capacitor, what value capacitance and so on. This is the reply:

In reference of your letter in which you asked for more information of the matter and the capacitance value of this device.

To explain, at the moment I am getting ready for the wet season, which is fast approaching. In the Northern Territory there is a lot of thunder and lightning and I intend to tap a lightning flash to measure the amps and volts.

Then I will be able to tell you more about the microfarads. I want to store this power into a small capacitor first, so I can learn more, and later into bigger capacitors. So it's important for the capacitor to be able to accept a quick charge. From about Christmas onwards I hope to have some interesting news about dealing with the blue light in the sky, and high voltage DC storage capacitors.

I hope you understand my point of view, as I am really determined to make this possible, with your support and knowledge. (Patrick McCool, Sanderson NT.)

There are many aspects of electronics and electrical engineering that I claim limited, even no experience in. Capturing lightning is one of them. I'm therefore presenting this letter in case there might be other readers who have an interest in this sort of thing, and who could be able to help. But I did a bit of research into lightning, and discovered some interesting facts. First, the breakdown voltage of air is around 20kV per cm, or 200kV per metre. Lightning occurs when there's a high enough potential difference between the plates of the capacitor formed by a charged cloud and earth (or another cloud). Note my use of the word 'capacitor'.

For a lightning strike, a cloud 100 metres in the air must, by these figures, have a potential difference relative to earth of around 20MV (that's 20 *million* volts!). A cloud 100 metres in the air is flying rather low, so I suggest 20MV is a very conservative figure. But it's quite a high voltage rating for a capacitor...

The direction of a lighting flash is usually from cloud to ground, with the cloud positively charged. Apparently the earth always has a negative charge, although a cloud can become more negative than Earth. Most lightning flashes are multiple events, of up to 42 main strokes, each of which is preceded by a leader stroke. All strokes follow an initial ionised path, which may be branched.

The average interval between successive lightning strokes is 20 milliseconds and the average flash lasts about 0.25 seconds. Because the duration of one powerful stroke is no more than 0.2 milliseconds, the intervals between strokes account for most of the duration of a lightning flash.

Nikola Tesla and Benjamin Johnson are names that come to mind when discussing lightning, but no doubt there are many others. There are numerous texts on Tesla that deal with his experiments, which might give you some ideas, Patrick.

Otherwise, all I can say about attempting to capture a lighting flash, or part thereof, in a capacitor is **BE CAREFUL**. I have no idea how you would go about this, as the voltage of a lighting strike, and the energy contained therein are such large values, if only for fractions of a millisecond.

Still, like all things, there's no doubt a way and I'll be most interested in how you go about this, and what you discover. But obviously, the type of storage capacitor you are dealing with is not your average high voltage capacitor. It would be *very* special indeed.

Full names

While I'm on a soap box about rules of journalism, I thought it about time we changed a long-standing convention in this column. For as far back as I can remember, and for reasons lost in history, we have al-

ways given only the initials of contributors, and rarely their full name. This runs counter to most newspapers and magazines, even our own Forum column, in which the contributor's full name is given after a letter.

So, unless you ask otherwise, we'll follow this convention from now on, and give full credit to each contributor for their letter. It's nice to see your name in print, and it's rare that the subject matter requires anonymity. Your full address won't be included, simply your town and state, unless you are seeking help from other readers — like the next writer.

270° meter movement

I wonder if you or an Electronics Australia reader can help me locate an unusual, or at least very hard to find part. I am after an analog meter movement, of around 10cm diameter, but with at least a 180°, or preferably 270° pointer movement.

This is because about 10 years ago I assembled an ETI kit for an electronic tacho, based on an LM2917 frequency-to-voltage converter chip to drive a string of LEDs. Although the kit has worked flawlessly over the years, I've often thought it would give a better appearance if I could connect it to drive an analog meter movement.

I was also wondering if the in-built tacho units that come with later model cars use a similar scheme to this project, i.e., they count the rate of ignition pulses via a wire from the distributor, rather than from a mechanical coupling to the engine. If so, then such a movement may be obtainable from a wrecker. (Ian Dodds, 26 Gillon St, Karawara, WA.)

I am familiar with the type of meter movement you are after, Ian, and I'm sure the tacho from a car would suit. I have been unable to find any such meter movements listed in the catalogs I have access to, but if you locate a supplier, I'll bet they would be expensive.

To the best of my knowledge, most car tacho systems use the ignition pulses to produce a voltage that drives a 270° moving coil meter movement. In other words, the meter movement is simply a voltmeter, like your LED display.

How you interface the movement to your circuit is another matter, although I imagine this wouldn't be difficult. And sticking with matters automotive...

Fuel consumption

In October a reader asked if we might consider developing a car fuel consumption meter. My reply explained that making such a device to suit all cars was almost impossible. I concluded with the thought that it would be a nice addition to a car, and asked why car manufacturers hadn't got onto this. It seems they have...

Some prestige vehicles fitted with fuel injection do have a fuel consumption meter, often in conjunction with a trip computer. It works by measuring the duration of the injection pulse and correlating that to an amount of fuel used.

However, as fuel is constantly circulated by the pump from the tank to the fuel rail with any excess going back to the tank, the fuel temperature increases (apart from ambient temperature variations). The fuel computer must therefore be calibrated to allow for this temperature rise.

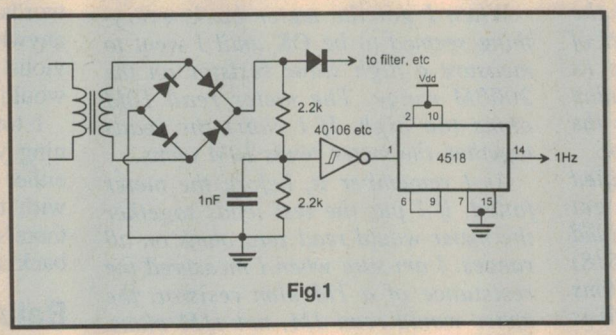


Fig.1

That calibration is different for each vehicle model, so it is not possible to have a universal 'add-on' system that will give accurate results.

Another method is to insert an accurate (read expensive) flow meter in the fuel line. However, the computer must still compensate for fuel temperature, so a temperature sensor is needed along with a calibration formula.

I really wonder if it is any more than a gimmick, to amuse motorists stuck in peak hour traffic — by watching the read-out slowly drop to zero kilometres per litre?

Incidentally, I am involved in building special vehicles for the Mileage Marathon. We hold the world's record for a two-stroke engine at about 1084mpg (380km/l). However to put that into perspective, the Honda Japan team came to Amaroo Park Raceway this year and won with 4800mpg (1695km/l) using a four-stroke engine, and the world record is currently around 8000mpg (2854km/l).

To measure the fuel used, the scrutineers weigh the fuel very accurately when it is added to replace that used during the 20- lap event, and compensate for temperature before and after. It is all done with computers. (Colin MacKinnon, VK2DYM.)

Thanks for this information Colin, and for the interesting figures on fuel economy. Yours is not the only letter I've received about a fuel economy meter, and I should have made it clear I knew about the role trip computers have in this. What I meant was a fuel economy meter as a stand-alone option, like a tacho.

You obviously agree that to design a universal fuel economy meter is quite a challenge. However, we are looking at the possibility of a trip computer project, which hopefully will include a fuel economy option.

Temperature alarm

The next letter is also on the subject of motor cars.

I have recently just avoided cooking the motor in my diesel Landcruiser, after the radiator split. It was only good luck that I looked at the temperature gauge in time.

Could a circuit be developed to trigger a buzzer when the radiator temperature reached a certain point? I think the temperature gauge in the vehicle operates from a resistance change in the sender unit. (Ed Grygorowicz, Rowville Vic.)

Many possibilities come to mind on how to do this. What we need is the simplest way. There's likely to be a commercial unit available, and perhaps a reader (or supplier) might be able to help.

I'll rattle off a few ideas, but I can't give you a ready-made design for such a device. A simple method is to use the needle of the temperature meter to trigger an alarm. This could be done with contacts, optically, with magnets (reed switch) or even a mercury switch.

A more elegant way is to build a separate temperature sensing circuit. Two possible designs you might look at are our Budget Priced Temperature Control unit described in August '94, and the Temperature Controlled Switch, in August '93.

Both these circuits operate from +12V DC, and might be adapted to this use. I think the August '94 circuit best suits your needs as it uses a thermistor as the temperature sensor and appears

to cover the required temperature range.

1Hz generator

In August '94, a reader enquired about a circuit to produce 1Hz pulses derived from the mains. Last month I presented a solution based on a special, though readily available IC. But here's another way, that may be even simpler.

About 18 years ago, I designed a circuit to generate a 1Hz mains-derived signal to pulse a calculator key every second, so I could keep an eye on the labour cost of workshop repairs. I used a portable calculator with a constant addition feature to do this, allowing it to add the charge-out rate per second, thus always displaying the labour cost to date.

At the start of the day I enter the hourly rate, divide by 3600 (number of seconds/hour) and place this in memory, to be recalled at the beginning of each job. The power supply for the generator also powers the calculator.

When the 50Hz is full-wave rectified without a filter capacitor, you get 100Hz pulses which are easily divided down by a dual-decade counter (4518) to give 1Hz pulses which are 200ms long. A Schmitt trigger (e.g., 40106) is required to square up the 100Hz signal to give reliable triggering of the counter. The output of the full-wave rectifier is fed via another diode to the filter capacitor and remaining circuitry, as shown in the circuit. (Graham Cheer, Tauranga, NZ.)

Graham's circuit is shown in Fig.1. I have used similar circuits in the past, and from experience, I suggest also adding a 0.1uF capacitor from the output of the bridge rectifier to ground. This helps remove transients that might appear on the mains, perhaps due to a nearby appliance switching on, or from some other form of interference.

Otherwise, there's a simple way to get a 1Hz signal, and also a useful tip for calculating the repair bill.

Suspect repair job

It's sometimes difficult to remember how something behaved before it became faulty. Then when you get it back after a repair job, you're not quite sure if it's doing everything the way it used to. Our next correspondent has this very problem, although I think he's being conned a little. See what you think...

In June 1994 I put my digital multimeter model Q-1535A in for repair, as I had touched the meter probe to a high voltage, causing the meter to fail.

When I got the meter back, everything seemed to be OK until I went to measure a high value resistor on the 2000M range. The meter read 10M ohms too high. If I short the leads together, the meter reads 10M ohms.

As I remember it, before the meter failed, if I put the test leads together the meter would read zero ohms on all ranges. I am sure when I measured the resistance of a 1M ohm resistor, the meter would read 1M, not 11M ohms. Or if I measured a 10M ohm resistor on the 2000M ohm range, it would not read 20M ohms.

As all the measurements on the 2000M range read 10M too high, I took the meter back to the repairer in July. When I got the meter back it was still the same, so I took it back again.

A technician then came out to deal with me, claiming the meter was within its specifications. He even brought out another meter and showed me it read the same way. I have a feeling it was another meter with the same fault.

It was explained to me that the readings were within 5% of 2000M ohms. But the way I have always understood a 5% meter reading is that measuring a 1M ohm resistor should give a reading of 1M plus or minus 5%. It seems to me that a reading of 11M is a little out of tolerance. Correct me if I'm wrong. (Robert Mills, Matraville, NSW.)

Your argument seems fine to me, Robert. For most digital meters, the accuracy is quoted as a percentage of the reading, plus or minus a few digits. So if the meter is 5% accurate, a 1M resistance value should give a reading somewhere between 0.95M and 1.05M ohm.

If as suggested by the technician, the accuracy figure is for a full-scale deflection value of 2000M ohm, a reading would be in spec if the displayed value was +/-100M ohm. In other words, a 1M resistance value could be anywhere from 101M ohm to zero. Obviously, a meter with this specification would be useless.

I totally agree that someone is spinning you a line. If a digital ohmmeter, either repaired or new, reads 10M ohm with the probes shorted together, then there's something VERY wrong. Take it back and ask to see the manager!

Baluns

Most of us are familiar with the 300 ohm balanced-input, 75 ohm unbalanced-output balun used to match a TV antenna to coaxial cable. It has another use, as the next letter explains, although the writer has considerable doubt about the various balun configurations he's looked at. They just can't work!

Could you explain what seems to me to be incorrect design of the common balun used widely with TV and FM antennas. My quandary arose after diagnosing the possible cause of interference with TV reception in the western suburbs of Perth, with the help of the AGPS booklet, 'Better Television and Radio Reception, your Self Help Guide'.

To overcome diagonal lines on the screen, probably caused by a nearby transmitter, a 'braidbreaker' or 1:1 transformer is recommended. Since I could not get one of these locally, I decided to make one.

I opened up an old 300/75 antenna balun and using it as a basis for the design, I made a 75/75 ohm braidbreaker on a balun core bought for the purpose. It appeared successful in preventing the interference.

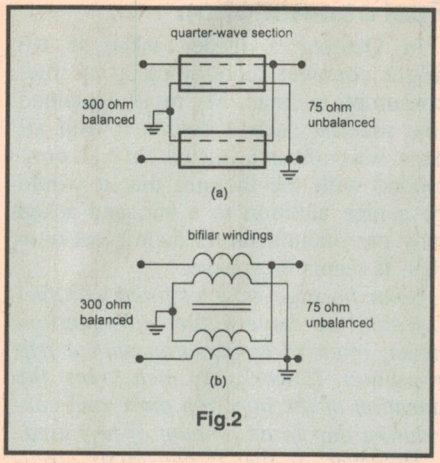


Fig.2

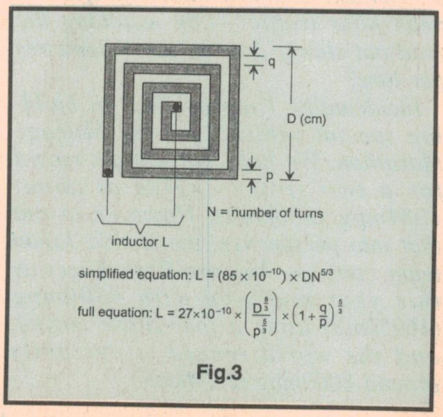


Fig.3

I decided to make a second braidbreaker from the old 300/75 unit by disconnecting the terminations, then rearranging them appropriately. It was then I found that the windings were not as I had assumed. In fact, one of the windings had both ends connected to the common terminal. A shorted turn!

I climbed up to my TV antenna and checked the connections of its balun. It was the same. As the two had been obtained from the same source some years ago, perhaps this was an error in the batch. I reconnected the balun to the same configuration as my first braidbreaker and judged the change as improving the picture reception.

Out of interest I visited the electronics store where I had bought the baluns and antenna some three years ago, and purchased another balun. On opening it, I again found both ends of one winding connected to the common terminal. The technician at the store was as puzzled as I.

Looking through what literature I could find, I found the FM tuner article in your August 1975 edition. Lo and behold, on page 39 a balun circuit and winding directions, but again with one winding having both ends connected to ground. As well, the 300 ohm inputs do not have similar paths to the common, and therefore appear not to be balanced in impedance. I don't understand. Perhaps at megacycles, things change.

Can you explain? It appears that my assumptions about how a balun works are wrong, or else there are a lot of faulty units about. (R. Kirkham, Wembley Downs, WA.)

You've really answered your own question here Mr Kirkham. At 'megacycles' (or MHz), things definitely do change. What appears as a short-circuit at a low frequency becomes a totally different thing at 100MHz or so.

In effect, a balun can be considered as comprising two 150 ohm quarter-wave sections, as shown in Fig.2(a). When 'looked at' from the balanced end, the two sections are in series, giving a 300 ohm impedance.

The ground point at the unbalanced side is isolated from the balanced inputs by the quarter-wave sections. Otherwise as you say, the balanced inputs are not equally related to ground. At the unbalanced side, the two quarter-wave sections are connected in parallel, giving a 75 ohm impedance, with one side connected to ground.

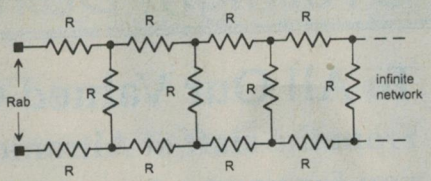


Fig.4

From the diagram in Fig.4:

$Rab = 2R + R//Rab$

$Rab - 2R = R \times Rab/(R + Rab)$

$(Rab - 2R)(R + Rab) = R \times Rab$

$Rab^2 - 2\,R\,Rab - 2R^2 = 0$

This is a quadratic equation where:

$a = 1$

$b = -2R$

$c = -2R^2$

The solution is given by:

$$Rab = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

substituting:

$$Rab = \frac{2R \pm \sqrt{2R^2 + 8R^2}}{2}$$

gives:

$$Rab = R\left(1 + \sqrt{3}\right) = 2.732R$$

The equivalent to a quarter-wave section can be achieved with bifilar windings, as in the circuit of Fig.2(b). A bifilar winding is one where the primary and secondary windings are wound together. That is, wind two pieces of wire at the same time onto the core, giving two windings that are closely interleaved.

The circuit in Fig.2(b) is from a text on the subject (*Basic Television*, Grob), and agrees with the circuit you refer to in *EA*. There might be other configurations, but at least we have two references agreeing.

Incidentally, your modifications to the antenna balun might give an improvement to the reception in the same way I once found I could improve reception of a client's TV set by shorting the antenna terminals together. High frequencies don't follow the same rules as lower frequencies!

PCB inductor

I've had a number of letters asking about the equation for a PCB inductor I presented in September '94. It seems my diagram left out one important detail: the measurement unit. I've reproduced the diagram and equations in Fig.3, where you can see the dimensions are in centimetres.

October's What??

I've also had quite a few letters giving solutions to the October What?? question. The answer to this question was given without proof, with the invitation for readers to send in a solution. I haven't space to include all the solutions sent to me, but I'll try and include them over the next few months. The first of these is from Glenn Baddeley, Surrey Hills, Victoria. Glenn's solution to the problem is shown beneath Fig.4.

What??

This month's question is from Steve Bullock, of Boronia in Vic. He writes:

I don't claim originality for this problem, except for changing the scenario to one of an electronic flavour. When I first came across this problem some years ago, I found the combination of arithmetic and logic to be most enjoyable and stimulating. Here's the question:

When the serviceman examined the circuit board, it was obvious that a section of the circuit had been cooked. In fact, three resistors were so discoloured that their values could not be read and a quick test showed that all three were open-circuit. Not having a circuit diagram for this model, the serviceman phoned a friend who he knew had the circuit.

"It's easy," said the friend, "the product of the three resistances is 2450, and the sum is twice the value of the input resistor." Being accustomed to his friend's cryptic ways, he set to work, locating the input resistor and doing some sums. He was soon back on the phone asking for more information. "Yes," said his friend, "I should also have told you that the bias resistor is the highest value in the circuit."

The serviceman then had to work out which of the three values applied to each of the burned resistors. The question: what is the value of the bias resistor?

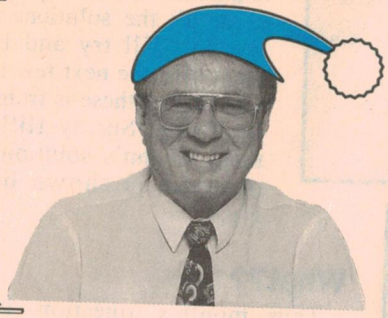
Answer to November's What??

The equivalent component is a 1k resistor! When the circuit's equivalent complex impedance is mathematically developed, you will find that the reactive part of the equivalent impedance is zero at every frequency, if $R_2 = L/C$ (true with the given component values).

Thus the circuit behaves as a pure resistor at all frequencies. The value of this resistor is the real part of the derived complex impedance, which by substitution works out to be R, in this case 1k ohm. ❖

ALTRONIC COMPONENTS • Overnight Delivery • AUSTRALIA WIDE

ALTRONICS - FAX (09) 328 3487



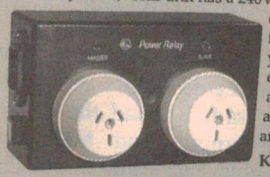
To All Our Valued Customers

From the staff at Altronics we thank you for your patronage and wish everybody a Merry Christmas and a Happy New Year!

Regards 'Santa' Jack



Auto Power Switch Master/Slave Kit



(See EA Jan '92) This unit has a 240V AC mains input and 2 240V AC outputs. The second output is automatically switched on when the first output draws current. For example, plug in your amplifier to the first output and your CD player, tuner and tape deck etc into the second output and each time you turn on the amp all the others automatically power up. Also great for computers and printers etc. etc.

K 6070 Normally $59.95

This Month Only $49.95

Beat Triggered Strobe Kit



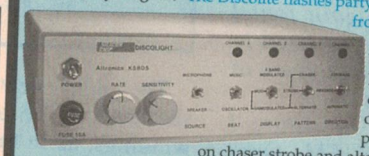
(See AEM July '85) Designed by Australian Electronics Monthly. Flashes in time to your music. Will also work as normal strobe. Exclusively customised by Altronics into our H 0480 Instrument Case, making construction a breeze and improving stability, safety and overall appearance. Includes silk screened panel. Two tube option available which boosts lighting output.

K 5790 Strobe Kit **$79.95**

K 5795 Two Tube Option **$16.50**

Flashes in Time to the Music!

DiscoLite Chaser & Colour Organ Kit



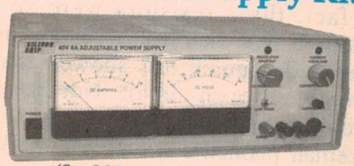
(See SC July/Aug '88) The Discolite flashes party lights on and off in beat with music from your amplifier.

Features: • 4 light channels controlled by 4 separate audio channels • Forward reverse and auto-reversing chaser patterns • Simultaneous strobe on all four channels • Alternating light patterns • Music modulation available on chaser strobe and alternate patterns • Inbuilt microphone or direct inputs for beat triggering or audio modulation of lights • Sensitivity control • Individually pre-settable sensitivity levels for each channel • Front panel LEDs mimic light display • Altronics Kit pre-punched and silk screened

K 5805 **$159.50**

Add Some Colour to Your Next Party!

Adjustable 0-45V, 8 Amp Bench Power Supply Kit



(See SC Jan/Feb '92) Using state of the art circuitry this supply will be a great asset to the enthusiast and professional alike. It uses switch mode principles which allows for smaller transformers, and heatsinking which means greater efficiency, less heat and lighter weight.

Features: •Variable output •Variable current limit •Separate Earth Terminal •Individual Volt and Amp Meters •Constant 13.8V setting •Short circuit proof

K 3360 **$399.00**

6 & 12V Gell Cell Chargers



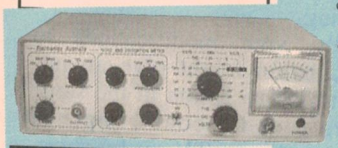
(See SC July '89) Includes red and black colour coded spade terminals for easy connection to most gel cell batteries. A dedicated IC monitors the charge and intelligently varies the rate accordingly. Charging current 300mA. Available for 6 and 12 volt gell cell batteries.

K 1685 12 Volt Version **$26.50**

K 1686 6 Volt Version **$26.50**

Noise & Distortion Meter Kit

Why Pay $$$$ for a Commercial Unit??



(EA May/June '93) A commercial noise and distortion meter would probably cost three to five times our kit price. It delivers performance at a budget price. Measures distortion levels down to less than 0.01 % at spot frequencies of 100Hz, 1kHz and 10kHz as well as providing a built-in low distortion oscillator and AC milli-voltmeter.

K 2542 Normally $129.00,

This Month Only $99

50W Mosfet Amp Module Kit



This great module features moderate power output at low harmonic distortion. Simple to build and compact in size this unit makes a great replacement module for your old Hi-Fi or buy two and make your own stereo amplifier.

Ultra Compact Design!

Requires ±50V DC supply

Specifications:

Power Output: 50W into 8Ω
64W into 4Ω

Freq. Response:.....25Hz-20kHz,±1dB

Input Sensitivity: 1V RMS

Input Impedance:.....47kΩ

T.H.D.:.....0.05%

K 5115 **$54.95**

Digital High Performance Signal Generator Kit



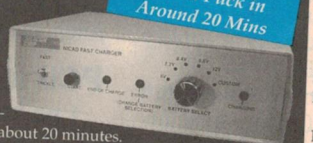
Ideal for Audio Experimenting and Servicing!

(SC July '90) This Digital Sine-Square Wave Generator uses high speed CMOS ICs and a digital filter IC to produce sine and square waves over the frequency range from 0.1Hz to 500kHz. It also features a 4-digit frequency readout and an output level control. Includes professionally screened and pre-punched front panel.

K 2547 **$155.00**

High Capacity Fast Charger for Nicad Batteries Kit

Charges a Typical NiCad Pack in Around 20 Mins



(See SC Jan '91) This charger is designed to operate from a 12V battery. It can charge 6V to 12V nicad battery packs at up to 6A, or you can custom wire the unit to charge battery packs up to 30V at a reduced current. In operation the circuit will recharge a typical nicad racing pack in about 20 minutes.

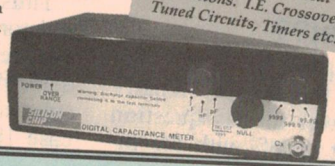
Features: • Fast charge rate • Switch selectable voltage setting in 1.2V steps from 6-12V • Fully punched and screened front panel • State of the art digital circuitry

K 1660 Normally $129.00,

This Month Only $99.00

4-Digit Capacitance Meter Kit

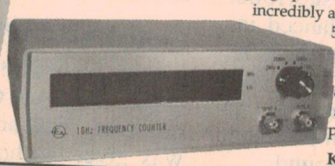
Perfect for Hand Selecting Capacitors for Critical Applications. I.E. Crossovers, Tuned Circuits, Timers etc.



(See SC May '90) This attractive 4-digit capacitance meter is designed for the workshop or laboratory. It can measure capacitance from 1pF up to 9999µF in seven ranges with an accuracy of better than ±1%. An over-range LED flashes whenever the capacitance value is too large for the range selected.

K 2524 **$119.95**

1 Ghz Frequency Counter Kit



(See EA April '93) This amazing high performance 1GHz frequency meter features an incredibly accurate 7 digit LED display, 2 BNC inputs 0-50MHz and 50MHz-1GHz) and 4input ranges (2MHz, 20MHz, 50MHz and 1GHz). An absolute must for the serious hobbyist and technician. Includes professionally screened and pre-punched front panel.

K 2517 **$145.00**

A 1GHz Counter for Under $150

FREECALL 1-800 999 007 **PERTH (09) 328 1599**

AUSTRALIA WIDE • Overnight Delivery • ALTRONIC COMPONENTS

General Purpose Mains Transformers



These transformers have been designed to give a multitude of outputs by either connecting the secondary windings in series or parallel. All models have flying leads 175mm long and all secondary taps are solder tags. Approved to Australian Standard AS 3108. Energy Authority approval CS 341/W.

Ideal for High Current Power Supplies etc!

60VA Type
M 2165 **$26.50**

Output voltages & currents available

Voltage	Current
9V	6.6A
12V	5A
15V	4A
18V	3.3A
21V	2.9A
24V	2.5A

100VA Type M 2170 $29.95

Output voltages & currents available

Voltage	Current	Voltage	Current
12V	8.3A	27V	3.7A
15V	6.6A	30V	3.3A
24V	4.2A		

120VA Type M 2175 $42.50

Output voltages & currents available

Voltage	Current	Voltage	Current
12V	10A	27V	4.4A
15V	8A	30V	4A
24V	5A		

3.75 Digit Auto Ranging Multi Display Multimeter with RS-232 Interface



Features serial RS-232 computer interface for advanced signal monitoring and data logging. Minimum, maximum and average function. Memory hold. Continuity check. 8 kinds of logic level test. 3.75 digit, 3999 count main display, with 3 other subsidiary displays and a bargraph. Capacitance meter. Warning buzzer sounds when leads are incorrectly inserted according to the current mode of operation. Battery low warning indicator. Frequency test function. Auto power off. Manual and automatic ranging modes.

Q 1048 **$239.00**



Includes Professional Carry Case, RS-232 Serial Computer Interface and 5.25" PC Software!

CADIK Professional Gas Iron

For Situations Where 240V Mains Power is Not Readily Available, This Fully Portable Self-Contained Iron is Ideal for Most Electronic Soldering Applications!



Only **$39.95**

Includes Blow Torch Tip & Bench Stand as Standard

The advanced CADIK Soldering Iron offers a convenience and a range of functions that redefine the limits of soldering.

Features: • See through gas chamber • Built in ignition cap • Uses standard butane gas • Comes with safety bench stand • Supplied with bonus blow torch tip and replacement lighter flints • Produces up to equivalent 60 watts of power.

With a sleek, pen like design and self-contained butane power it is easily carried and ready for use virtually anywhere. One single refill of the iron's gas reservoir (from a standard butane refill can) allows up to 60 minutes of continuous use with temperatures ranging from 400°C to 1300°C.

T 2500

This Month Receive Free T 2447 Gas Refiller Valued at $4.95 Limited to 1st 100 Customers

Full Range of Replacement Tips Available

Micron 25 Watt Soldering Iron with De-solder Bulb & Solder



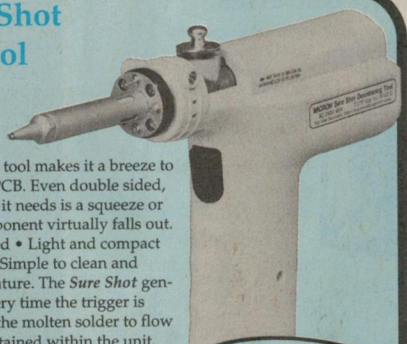
This combo pack makes excellent value for the person starting out. It gives you a lightweight, economical soldering iron witch is suitable for most electronic work including a variety of car and household jobs.

T 2415 **$20.95**

T 2416 Spare Tip to Suit **$2.95**

This Month Includes Bonus T 1310 Soldering Iron Stand. Valued at $13.95 Limited to 1st 100 Customers.

Micron Sure Shot Desoldering Tool Mark II



Exclusive to Altronics in Australia. This stand alone, fully self-contained desoldering tool makes it a breeze to remove components from any PCB. Even double sided, through hole plated boards. All it needs is a squeeze or two on the trigger and the component virtually falls out.

Features: • Totally self contained • Light and compact • Anti static tip • Easy to use • Simple to clean and maintain • Variable tip temperature. The *Sure Shot* generates a high speed vacuum every time the trigger is squeezed. This vacuum causes the molten solder to flow into the collection reservoir contained within the unit. Here the molten solder solidifies into small particles. With its inbuilt variable temperature control the *Sure Shot* is ideal for single sided, double sided and through hole plated P.C.B.'s. With just a couple of squeezes of the trigger all holes are left solder-free for easy removal of the component.

De-Solders a 14 Pin IC Socket in Around 30 Seconds!

T 1280 **$349.00**

T 1282 1.0mm Replacement Tip to Suit **$34.95**

T 1283 1.6mm Replacement Tip to Suit **$34.95**

Bonus This Month Receive a T 2490 CADIK Gas Blow Torch That's $29.95 Value for Free!

Bench Stand to Suit

T 1274

$24.95



CADIK Micro Jet Gas Blow Torch

Powered by a common disposable type gas lighter (not supplied), this unique blow torch burns at 1300°C, making it ideal for all types of brasing and heavy duty soldering.

Micron Series II Soldering Station



Quality Ceramic Element Means High Efficiency Heating!

The *MICRON* Series 2 soldering station employs electronic switch mode circuitry in lieu of a mains transformer. Excellent for all general purpose and production soldering.

Features: • High insulation ceramic heating element in both rapid heat-up and instant recovery • Heater insulation of over 100MΩ • A zero voltage circuit ensures no high voltage spikes or magnetic field are present at the tip to damage sensitive components • Continuous temperature adjustable from 250° to 430° C (480° to 800° F) • Grounded power cord Selecting the desired operating temperature is as simple as turning a knob. Simply choose the operating temperature required for the job and adjust the control to the appropriate setting. With its huge temperature range from 250° to 430° C this iron is suitable for most applications, from delicate double sided PCB's through to typical day to day jobs.

T 2443 **$129.95**

Plug Packs



Our range of adaptors are each fitted with a 1.8M lead, in line socket and M 9014 2.5mm DC connector (different adaptor plugs available as below). Simple polarity setting. All energy authority approved.

30% OFF! Ideal for Those Christmas Toys!

Cat. No.	Output Max. Normal Voltage(s)	This Current	Price	Month
M 9002	12V DC	300mA	$15.95	$11.15
M 9004	9V DC	300mA	$15.95	$11.15
M 9022	12V DC	1A	$24.95	$17.45
M 9027	16V AC	1.5A	$29.95	$20.95

19 Range Digital Multimeter



After evaluating 30 or more meters of this calibre we found the Q 1053 to be the best value for money by far!

This 3.5 digit multimeter features a 19 position, easy to use rotary switch for function and range position. Includes AC/DC voltage check, 10A DC current, resistance, diode and a transistor test function. This meter offers many of the features of much more expensive models but at the fraction of the cost. Ideal for the cash strapped student, or budding enthusiast!

Amazing Meter for Under $30!

Q 1053 Normally $39.95, **This Month Only $29.95**

ALTRONICS - FAX (09) 328 3487

FREECALL 1-800 999 007 PERTH (09) 328 1599

Doc.JH062

ALTRONIC COMPONENTS • Overnight Delivery • AUSTRALIA WIDE

ALTRONICS - FAX (09) 328 3487

4 Channel Economy Mixer

Voice Dub your Own Home Videos with this Easy to Use Mixer!



This compact mixer has inputs suitable for microphone, record players, camera audio, CD, Tape, and Tuner etc. Ideal for amateur cinematographers who would like to add their own background music and/or voice overs. Includes inputs for microphone, phono (with magnetic or ceramic cartridge), camera audio and an auxiliary (CD, tape, tuner etc). Features headphone output and master volume control. Requires 9V DC 300mA plug pack.

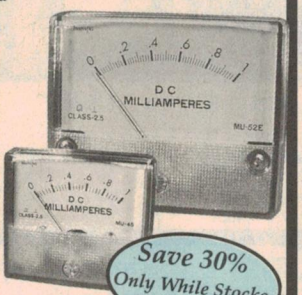
A 2520 **$119.00**

Chassis Mount Panel Meters

Available in 3 physical sizes and a range of ranges. All include mounting nuts, washers and chassis cutout template.

Dimensions:
MU45 Size: 58W x 52H mm Overall.
MU52 Size: 80W x 66H mm Overall.
MU65 Size: 100W x 82H mm Overall.

Cat. No.		Scale	Normally	This Month
Q 0500	MU45	1mA	$19.95	$13.95
Q 0505	MU45	50µA	$19.95	$13.95
Q 0506	MU45	100µA	$19.95	$13.95
Q 0508	MU45	1A	$19.95	$13.95
Q 0510	MU45	5A	$19.95	$13.95
Q 0515	MU45	10A	$19.95	$13.95
Q 0525	MU45	30V	$19.95	$13.95
Q 0528	MU45	VU	$19.95	$13.95
Q 0530	MU52	1mA	$21.95	$15.35
Q 0533	MU52	5A	$21.95	$15.35
Q 0535	MU52	30V	$21.95	$15.35
Q 0538	MU52	50V	$21.95	$15.35
Q 0540	MU65	1mA	$24.95	$17.45
Q 0550	MU65	100µA	$24.95	$17.45

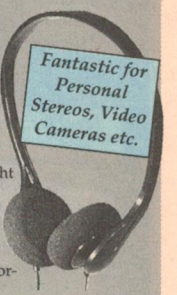


Save 30% Only While Stocks Last!

High Performance Portable Headphones

After rigously testing dozens of headphones, we found the C 9010 to be the best value for money by far!

Fantastic for Personal Stereos, Video Cameras etc.



Incorporating samarium cobalt magnets, high quality flexible lead with 3.5mm plug.

Features: • Light weight but very robust • 3.5mm stereo plug • Samarium cobalt magnets • Excellent reproduction and performance

C 9010 Normally $15.00

This Month Only $9.95

Ni-Cad Battery Discharger Kit

(See SC July '92) Designed to rid your nicad batteries of the memory effect and regain full recharge potential. It discharges your nicads correctly to enable a full recharge. Suits most battery packs. Great for mobile phones, battery drills, toys etc.

K 1640 **$24.95**

Rejuvenate Those Old Ni-Cad Batteries to Their Full Potential!



30 Watt Weather Proof Sound Monitors

Ideal for Hi-Fi extension, surround sound or outdoor use.

Features: • Rugged 'Luran S' Thermoplastic construction • Superb black or white finish • Engineer designed in Australia • Excellent reproduction • Superior to imports - yet a fraction of the price • All exterior fixings marine grade stainless steel • Speaker cones treated with special formula to repel moisture

8 ohm 30 Watt

C 0904 White
C 0905 Black

$105.00 each or $199.00 per pair



Ideal for BBQ Areas, Patios, Pergolas etc

Made

AA Solar Charger

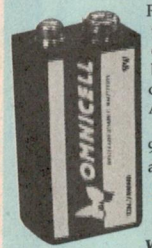


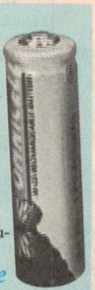
Charge Your Batteries Free From the Sun! Ideal for camping, boating, travelling etc. Simply insert the batteries and place in direct sunlight. eg on your car dashboard.

Charges up to 4 AA Nicads by simply placing in the sunlight. Will charge 1 battery in 2 to 3 hours, 2 batteries in 4 to 6 hours, 3 batteries in 7 to 10 hours and 4 batteries in 10 to 14 hours with full sunlight.

A 0230 **$14.95**

Premium Quality Nicad Batteries





Premium grade quality. AA and 9V size only. Great for those battery hungry toys, cassette players etc. AA size 500mAH.

9V size 100mAH (actual voltage 8.4V).

Ideal for those Christmas Toys!

	Was ea	Now ea	10 & up ea
S 5106 AA	$3.40	$2.95	$2.50
S 5124 9V	$17.95	$15.00	$13.00

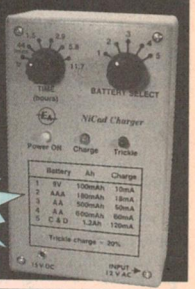
Automatic Charger Kit for NiCads

(EA July '89) Get 100's more recharge cycles from your nicads. It's now well known that correctly charging nicad cells greatly extends their service life. Here is a fully automatic NiCad battery charger that enables differing charge rates as appropriate for AAA, AA, C, D or 9V cells. Once the battery is charged, the unit automatically switches to trickle charge until you switch it off. It is fully featured, yet surprisingly simple. Requires 12V AC Plug Pack.

Features:
- Fully punched and screened case
- Variable charge rate
- Variable timer
- Flexible and simple to use
- Visual display of charge mode
- Nicads cannot be over charged

K 1650 **$39.50**

Keeps Your Nicads in Top Condition!



ALTRONICS

174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 3487
MAIL ORDERS C/- P.O. Box 8350
Perth Business Centre, W.A. 6849

Standard Delivery & Packing Charge: $4.00 to 500gms, $5.50 500gms-1 kg, $8.00 1kg-5kg. Where possible we process your order the day received and despatch via Australia Post. Allow approx 9 days from day you post order to when you receive goods.

Overnight Jetservice: Up to 3kg is $10.00, 3kg to 5kg is $18.00—We will process your order the day received (if placed before 2.00PM WST) and despatched for delivery the next day. Country areas please allow an additional 24-48 hours.

Heavy Service: All orders of 10kgs or more must travel Express Road—Please allow up to 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs.

Insurance: As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance".

Altronics Resellers: Chances are there is an Altronics Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ●. These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you.

© Altronics 1994/5. All possible care has been taken with the preparation of this advert and the information contained herein is correct at the time of going to press however specifications and particulars in relation to products referred to herein are subject to change without notice. Altronics takes no responsibility for any loss or damage howsoever caused suffered by a reader with respect to any matter or thing referred to herein. Prices stated herein are only valid for the current month or until stocks run out.

WA - COUNTRY

ALBANY	BP Electronics ●	(098) 412681
	Micro Electronics	(098) 412077
BUNBURY	Micro Electronics	(097) 216222
ESPERANCE	Esperance Comm.	(090) 713344
MANDURAH	Forum Electronics	(09) 5813466
PORT HEDLAND	Ivan Tomek Electronics	(091) 732531
ROCKINGHAM	TV Joe's	(09) 5271806

VIC - CITY

	All Electronic Comp.	(03) 6623506
	TECS ●	(03) 6706474
CHELTENHAM	Talking Electronics	(03) 5842386
CLAYTON	TECS ●	(03) 5629501
CROYDON	Truscott Electronics ●	(03) 7233860
FOOTSCRAY	G.B. Telespares	(03) 3266035
PRESTON	Preston Electronics ●	(03) 4840191

COUNTRY

BAIRNSDALE	Green Gage Services	(051) 525677
BALLARAT	Ballarat Electronics	(053) 311947
BENDIGO	Sumner Electronics	(054) 431977
MILDURA	Truscott Electronics ●	(050) 238138
SHEPPARTON	Andrew Guyatt Elect.	(058) 219497

QLD - CITY

	Delsound PL●	(07) 8396155
NEWSTEAD	E.C.Q.	(07) 2541153
WEST END	B.A.S. Audiotronics	(07) 8447566
WOODRIDGE	David Hall Elect.●	(07) 8082777

COUNTRY

GLADSTONE	Gladstone Elect. Services	(079) 724459
MAROOCHYDORE	Mals Electronics ●	(074) 436119
TOWNSVILLE	Super Solex ●	(077) 724466

TAS

HOBART	G.H.E. Electronics ●	(002) 342233
LAUNCESTON	G.H.E. Electronics ●	(003) 316533

NT

ALICE SPRINGS	Farmer Electronics	(089) 522388

SA - CITY

	Force Electronics ●	(08) 2125505
BRIGHTON	Force Electronics ●	(08) 3770512
ENFIELD	Aztronics ●	(08) 3496340
FINDON	Force Electronics ●	(08) 3471188
HOLDEN HILL	Force Electronics ●	(08) 2617088
LONSDALE	Force Electronics ●	(08) 3260901
SALISBURY	Force Electronics ●	(08) 2830755

NSW - CITY

	David Reid Elect. ●	(02) 2671385
SMITHFIELD	Chantronics	(02) 6097218
YAGOONA	Delta Components	(02) 7962888

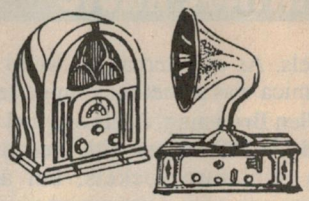
COUNTRY

COFFS HARBOUR	Coffs Habour Elect.	(066) 525684
NEWCASTLE	Novocastrian Elect.Supplies	(049) 621358
WARNERS BAY	Vilec Distributors	(049) 566792
WOLLONGONG	Newtek Electronics ●	(042) 271620
	Vimcom Electronics	(042) 284400

FREECALL 1-800 999 007 **PERTH (09) 328 1599**

Vintage Radio

by PETER LANKSHEAR



Building a 70-year-old classic

Last month we introduced one of the most widely known classic receivers of the 1920's, the Browning-Drake. Unusual in that sets were both factory made and home built, its design combined simplicity with good performance and economy, and it was the genesis of many successful designs made well into the 1930's.

If the number of inquiries I receive is any indication, a significant number of receivers based on the Browning-Drake have survived and been rescued, although some are in a somewhat dilapidated state and in need of restoration or even rebuilding. Many enthusiasts would like to have a Browning-Drake receiver in their collections, but, although there were thousands made originally, there will never be a sufficient number of original models to satisfy the demand. I do know of several Browning-Drake receivers that have been built successfully in recent years, not as a restoration of an existing set, but from individual components.

Although some pretty comprehensive rebuilds and 'cannibalisations' are undertaken by dedicated and skilled workers, it is rare for a replica of a factory production model receiver to be successful. To duplicate even the metalwork would be very difficult. There is just too much specialised processing and equipment required.

With the Browning-Drake, the situation is somewhat different. Although there were factory assembled receivers and 'official' kitsets, many others were made by hobbyists with limited resources and modest facilities, and no two of these sets were completely identical. It can be argued that, provided that genuine components from the appropriate period are used, the exact assembly date of a receiver of this nature is not vitally important.

An example was a recent project around the 'Little General' that we featured in our July 1992 column. This was taken up by North East Vintage Radio Club in Benalla, for the 1993 subject of their annual 'Hellier Award' construction project. The excellent entries all differed in individual detail, and although assembled 50 years after the original design appeared, authentic components were used, and the receivers are arguably genuine 'Little Generals'.

There are good precedents for this. The Antique Wireless Association of America, the world's pioneer and probably the largest vintage radio organisation, regards recreating amateur built equipment as a legitimate activity and regularly reports in their Bulletins on members' building of early equipment.

For several years I had been accumulating the necessary bits and pieces, gleaned as swaps, junk purchases, gifts and downright scrounging, and recently I found sufficient motivation to set about building a 'new/old' Browning-Drake receiver, based on instructions featured in the 1929/30 *New Zealand Radio Guide and Call Book.*

Wide range of valves

Some of the earlier Browning-Drakes were quite large, but this version is of more manageable proportions with a panel of 460 x 175mm. The days of radio stores stocking shiny black panels are long gone, and finding a suitable material today may take some effort. I used 5mm-thick black switchboard Formica. This is readily drilled and engraved, the only disadvantage being that the surface hasn't the extreme shine of the original



Fig.1: Mid-1920's radios were frequently housed in functional tabletop chest cabinets with lift-up lids; the chief variations being the degree of ornamentation. Cabinets like this could be made with basic tools or purchased ready made.

PARTS LIST

1	Black Formica panel 460 mm x 175 mm
1	Wooden baseboard
2	Tuning capacitors single gang, 350 pf - 500 pf
2	Coil formers, 750 mm dia
4	Valve sockets 4 pin baseboard mounting
2	Audio transformers
2	Rheostats, 6 ohm and 30 ohm
2	Tuning knobs
2	Small knobs
4	Terminals
1	Neutralising capacitor 5 - 50 pf
1	Mica capacitor 1000 pf
1	Mica capacitor 250 pf
1	Mica capacitor 100 pf
1	Grid leak resistor 1 - 5 meg.

Insulated wire, busbar, sleeving
Battery cable
Hardware
Approximately 35 metres (100 grammes) of 22 SWG (0.63 mm) enamelled wire

panels. As an alternative, wood grained Formica was sometimes suggested.

Glen Browning, in his original models, used UV199 valves with their own special miniature sockets, but as these valves are now very scarce — and the sockets even rarer — it seemed a better idea to use the standard four pin American UX socket, which suits a wide range of valves, including the electrically identical UX199. Many other types of valve are suitable.

Those fitted to the Browning-Drake in the photographs are a pair of Philips A609, one A615 and a Mullard PM6, and it works just as well as with the traditional 01A's and UX199's. Type 30 valves, with 2.0 volt filaments, likewise proved to be satisfactory.

The table of suggested types is far from exhaustive, and most general purpose battery powered triodes will be suitable. The chief requirement is for all the filaments used at one time to have the same voltage...

Tuning capacitors do not have to be identical; in fact, Browning's prototype used a 500pF unit for the RF stage and a 350pF type for the detector. The reason for this difference is the close coupling of the aerial, whose capacitance can be significant. This has the effect of restricting the tuning coverage by compressing the range of capacitance variation.

Some Browning-Drake designs even provide coil data for 250pF detector tuning capacitors, but the modern AM broadcast band covers a wider range of frequencies than in 1930, and now 350pF is the minimum recommended size.

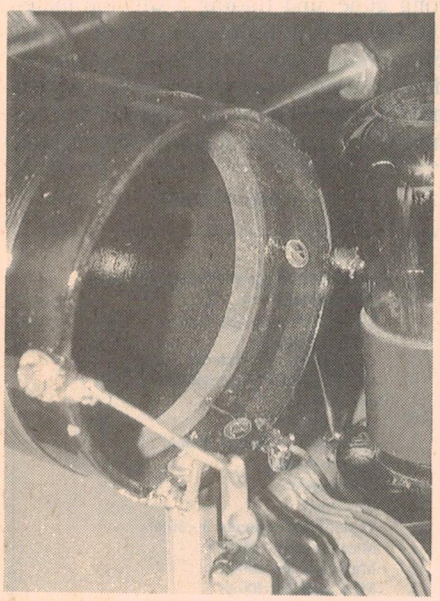
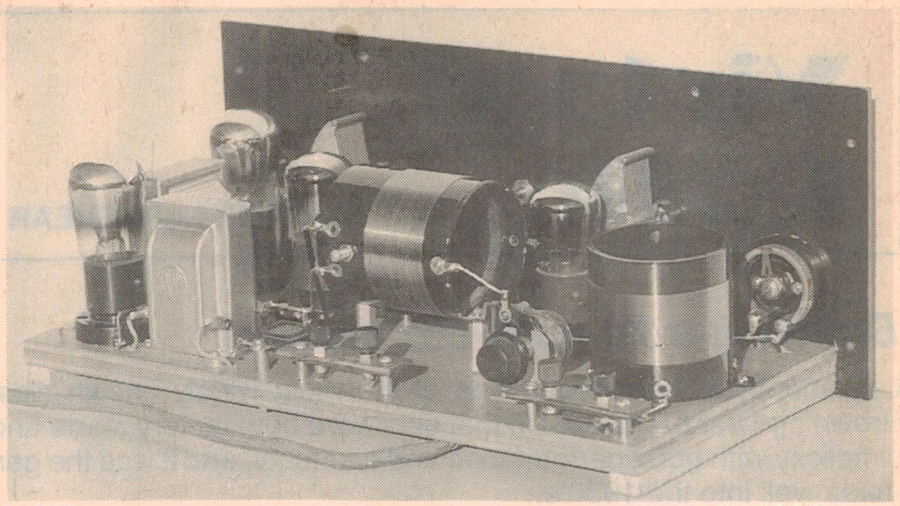


Fig.3: Detail of the detector coil, showing the position of the primary winding inside the main coil former. The tickler winding control shaft and its front panel bushing are visible at upper right, above the RF valve.



By modern standards, Browning-Drake components were huge — especially the coils, which were commonly about 75mm in diameter. There was no shielding, which was considered inefficient; instead mutual coupling was avoided by mounting the coils at right angles. The baseboard is raised by about 10mm to clear the filament and battery wiring — a technique often used in early sets.

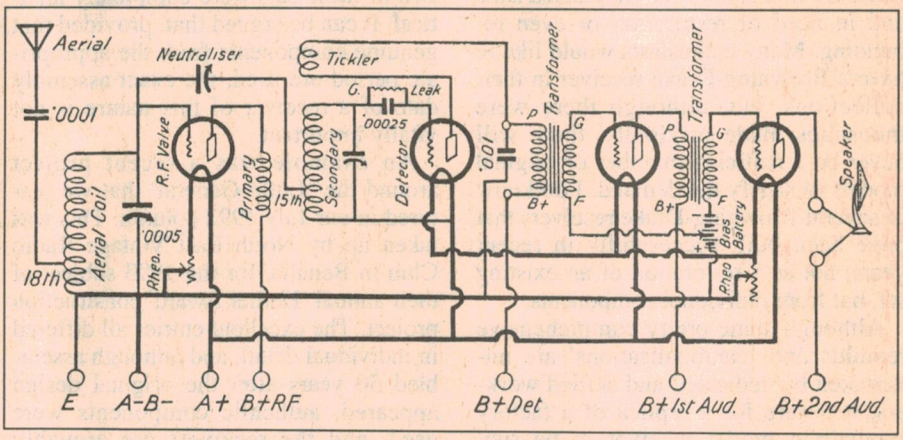


Fig.2: Few receivers ever packed as much performance into a very simple circuit as the Browning-Drake. Original versions had a rheostat for each valve filament, but otherwise this 1929 circuit is very close to the original.

Radio construction 60 - 70 years ago was not a matter of inserting components on to pre-drilled printed circuit boards! It was accepted that there could be a fair amount of 'user building' of components, especially tuning coils.

Large, efficient coils are essential to the good performance of these old receivers and are likely to require the most time and effort in this project. Formers were made from ebonite, Bakelite or some form of impregnated cardboard. I was fortunate to be given a pair of ebonite (hard rubber) formers, but today this material is unobtainable.

Even Bakelite coil former is scarce and it might be necessary to resort to cardboard tubing saturated with shellac or varnish. Some of the modern materials such as PVC or Alkathene pipe are ideal electrically and mechanically, but some purists would be offended by their use.

There were commercially made Browning-Drake coils, honeycomb wound without formers, and another popular method was to wind coils on sheets of celluloid wound round a suitable glass bottle as a mandrel. Coil diameter of all types should be about 3" (75mm), wound with 22 SWG (0.63mm)

wire; use 68 turns for 350pF and 56 turns for 500pF tuning capacitors. The tappings are not critical and can remain at 15 turns for the detector coil, and 18 turns for the aerial connection for either type of capacitor.

The Regenaformer

The most complex item of the project is undoubtedly the detector tuning coil or 'Regenaformer' and this does require a little lathe work for the primary and tickler (feedback) winding formers.

As explained last month, the significant feature of the Browning-Drake receiver is the special primary winding of the Regenaformer. This consists of only 15 turns of fine wire, wound as compactly as possible in a groove in a section of former located inside the main former and in line with the bottom of the tuned winding. Fig.3 should make this clear. Ideally, it should be turned out of Bakelite or hard rubber, but hardwood would be a practical substitute.

At the other (top) end of the Regenaformer is the feedback or regeneration winding, picturesquely called a 'tickler' (Fig.4). Through a 90° rotation, the tickler adjusts the amount of positive feedback, from minimal when at right angles to the main winding, to maximum with the windings in line. It is a good idea to fit stops to limit rotation, or some enthusiast is bound to twist the leads off!

The tickler has a total of 20 turns of fine wire, connected to the outside world with flexible leads. I used the braided voice coil pigtails from an old speaker cone. Some discarded volume control pots provided excellent bearings for the shafts of the tickler assembly. Fig.4 shows the general idea.

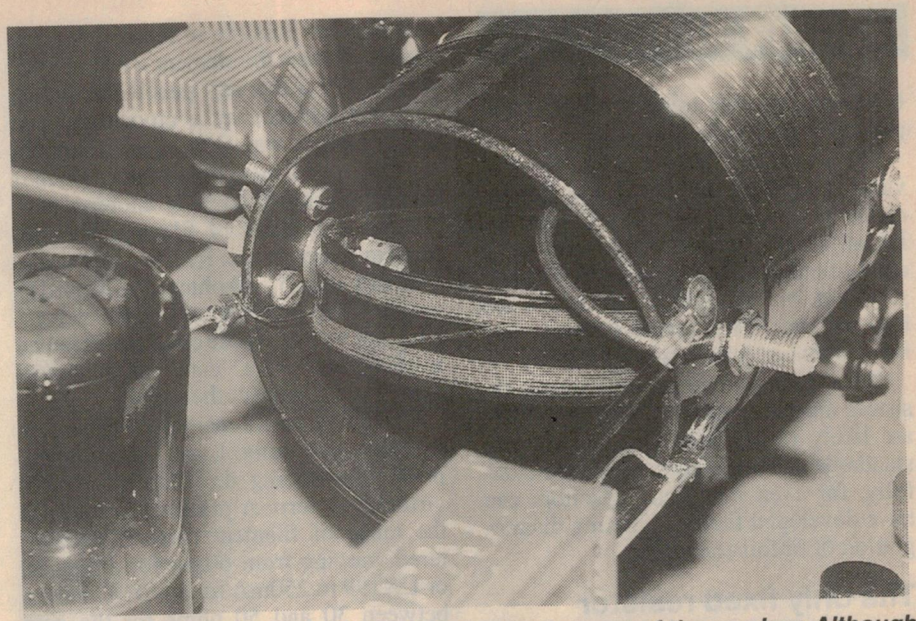


Fig.4: The tickler winding is the most complicated part of the receiver. Although not essential, the turned recesses in the tickler former are helpful in holding the winding in place. The shaft bushings came from old potentiometers.

Phasing most important

The correct phasing of the connections to the primary winding and the Regenaformer are absolutely essential, for neutralisation and regeneration.

Assuming that the three windings on the detector coil are in the same direction, and that the primary is at the *earthy* end of the tuned winding, with the regeneration winding at the other or grid end of the coil: then the ***start*** of the primary winding connects to the anode of V1 and the ***finish*** to HT.

In the case of the tickler, again with the winding sense and plane of the coils the same, the ***start*** of the coil goes to the anode of the detector valve and the ***finish*** connects to 'P' of the first audio transformer. It is worth taking extra care to check that the winding relationships are absolutely right — it may save undoing things later.

The audio transformers can have the usual ratios of 3:1 to 5:1, and although not essential, a matched pair looks well. I used AWA 'Ideal' units. Chances are, unfortunately, that the transformers will have open circuited windings. This need not be a disaster. We illustrated a method of rewinding audio transformers in this column for September 1991, and specialist rewinders are now advertising their services.

Faulty components

This brings us to the subject of component condition. Much of the work in a project of this nature involves renovating individual components before they are installed. Where possible, items should be dismantled, cleaned and if necessary, repainted or replated. Not only will they

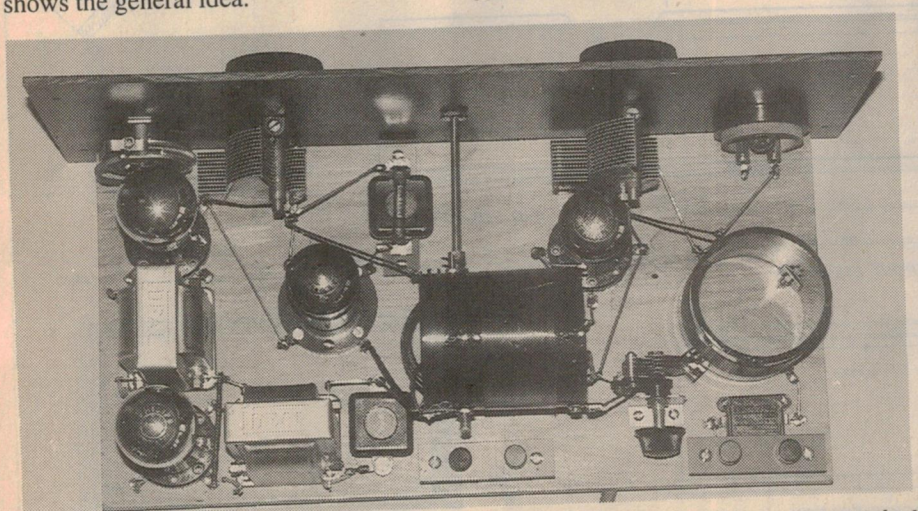


Fig.5: Cabinet and panel dimensions are sufficient to permit a compact but uncrowded layout. The relatively few components are screwed to the baseboard. They can be readily identified, with the aerial coil to the right, the detector coil and valve in the centre and the first audio valve at lower left.

SOME SUITABLE VALVE TYPES FOR BROWNING-DRAKE RECEIVERS

FILAMENT VOLTAGE	AMPLIFIERS RF & AF	DETECTOR	OUTPUT	OUTPUT BIAS
2.0	30 A209 PM1 HL210	30 PM1A HL210	31 P215	-22.5 -10.5
3.3	'99*	'99*	'20	-22.5
4.0	A409 A415	A409 A415	B405 P410	-18.0 -9.0
5.0	'01A* 112A UX221 PM5 C509	'01A* 112A UX221 PM5 200A C509	'01A* 112A '71A C503	-9.0 -9.0 -27.0 -27.0
6.0	A609 A615 PM5	A609 A615 PM6D	B605 PM6	-18.0 -7.5

* TYPES USED IN ORIGINAL B-D RECEIVERS

look better for this treatment, but unsuspected faults may be found.

In my case, the tuning capacitors provided a problem which had to be corrected after construction was completed. Initially they appeared to be in such good condition that no attention seemed necessary; but, out of sight, the bearings had become very dirty, creating havoc with intermittent operation when in use.

The remaining components are the resistors and three mica capacitors, which are likely to be quite large by modern standards. Check their capacitance carefully, for even moulded capacitors can have developed faults, including disintegration of tinfoil electrodes.

The only fixed resistor

It was common practice for detector grid capacitors to have a pair of clips to hold the only fixed resistor in many of the receivers of the period: the grid leak. Often, this was a glass tube with metal caps, containing a strip of carbon coated paper as the element, which is quite likely today to be open circuited. Some ingenuity will be necessary to fix this problem.

It may be possible to remove the end caps and renew the element with a strip of paper, with a few soft pencil line drawn over the surface; but a more pragmatic and far easier way is to insert a modern miniature 1 - 2 megohm resistor, which if painted black will be fairly unobtrusive.

Several patterns of filament rheostat were in common use. R2 has a low value, typically only 5 - 10 ohms, and is used to regulate the detector and audio valves' filament supply. These controls often had a blank section or 'cam', as an on/off switch to disconnect the supply.

The RF valve filament rheostat, R1, is the main gain control, and should be capable of reducing the filament current virtually to zero. A practical problem is the range of filament currents encountered, varying from 60mA for a type 30 or UX199 to 250mA for an '01A. Values between 30 and 50 ohms for the gain control are a reasonable compromise.

'Chest' type case

An important item is a suitable cabinet. The drawings are of a tabletop 'chest' style with lift-up lid, which was popular during the 1920's. With varying degrees of ornamentation, similar cabinets were used for many radios, and home constructors could buy them ready made or build their own.

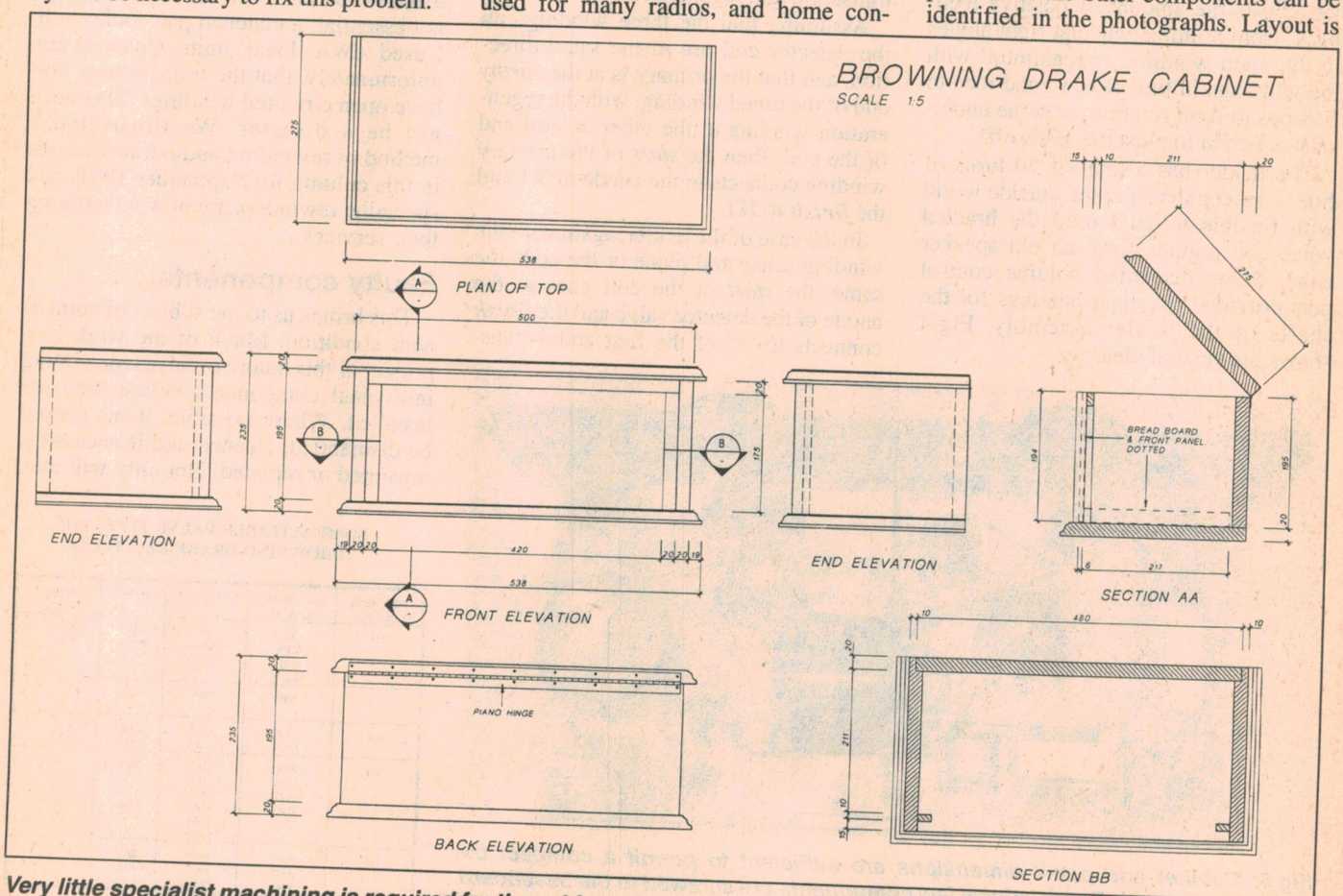
The one illustrated was made with basic home workshop tools, the only specialist machining being that of the edges of the lid and base. This work could be undertaken by a joinery workshop at minimal cost.

Any suitable timber

The timber used can be of practically any variety that appeals. Mine was made from an ancient oak bedhead, but many local timbers have very attractive grains. Any finish desired can be applied, and French polish would be very appropriate.

Attached to the panel is the all important 'breadboard'. The wood used should be stable and not prone to warp; 15mm plywood is ideal. As can be seen in the photographs, 10mm laths should be attached to the underside at the ends to provide wiring clearance. A couple of coats of shellac should be applied.

Now the components can be mounted. It is a good idea to start with installing the bushing for the Regenaformer shaft, which, for the sake of symmetry should be at the centre line of the panel. The position of the other components can be identified in the photographs. Layout is



Very little specialist machining is required for the cabinet. Mahogany, walnut and oak were used for early receiver cabinets, but many local timbers are suitable. It's a good idea to have the cabinet finished before cutting the front panel to final size.

not unduly critical, but to avoid unwanted coupling, the tuning coils should be mounted at right angles to each other. A similar precaution should be taken with the audio transformers.

Exposed wiring

There are two types of wiring. With the exception of the anode lead for V4, grid and anode wiring is in bare solid tinned conductor above the 'deck' and in the manner popular in the efficiency conscious 1920's, is strictly 'point to point' with black sleeving where insulation is essential. Supply leads, battery leads and the V4 anode lead are in traditional stranded hookup wire on the underside of the baseboard. As all terminations are above the baseboard, access holes are drilled under each terminal.

Lacing in bootmaker's waxed linen thread can be used to tidy up loose leads. Although it disappeared with the advent of mains powered receivers, above-chassis exposed point to point wiring remained popular in transmitter construction until quite recent times.

With the wiring completed, the receiver is ready for its first firing up. An aerial, preferably an outside type and 10 - 30 metres long, a loudspeaker and a power supply will be needed. If a classic horn speaker is not available, an ordinary moving coil type with a 5k to 15k output transformer will do, but bear in mind that, by today's standards, the sound level will be modest.

Suitable power supply

For a power supply, the Universal Battery Eliminator described in the March 1990 column is ideal. By the way, RCS Radio now stocks suitable printed circuit boards, making construction of these units easier and more professional looking than with Veroboard.

Before switching on, make doubly sure that the filament voltage is correct for the valve series used. Bias for the audio amplifier with 90 volts HT is 1.5 volts. Correct bias for output valves operating at 135 volts HT is given in Table 1. No bias is required for the remaining two valves, but some experimenting with their HT voltages for smoothest operation may be required. A good starting point is 68 volts for the RF stage and 22 volts for the detector.

With projects of this nature, in spite of all the right precautions taken with checking out components, there always seems to be some unexpected fault or malfunction. As mentioned previously, in my case it was dirty bearings on the tuning capacitors; so be prepared to do some troubleshooting.

With any faults cleared, back off the RF gain control and switch the filament supply on. The detector should go into oscillation with a 'plop' as the reaction control is rotated. If it does not do so with a healthy valve in the detector socket, and assuming that the phasing of the windings is correct, more detector voltage may be necessary — or, as a last resort, more turns should be put on the tickler.

With the detector working correctly and the regeneration control backed off to just *below* the oscillation point and with the RF gain control advanced, the two tuning capacitors can be brought into line. Stations should be heard, together with whistles and squawks, indicating that the RF stage is oscillating and requiring neutralisation.

Setting neutralisation

A signal generator may be necessary for this if you are not in a good reception area, but assuming that you are, tune in a strong signal near the middle of the band. Now cut the RF rheostat right off — if necessary, putting a piece of paper between the rotor and the resistor element. The signal will still be heard, although with reduced output. Adjust the neutralisation control for MINIMUM output, checking that the two tuning controls remain in resonance. There should be a distinct null as the neutralising capacitor is rotated. At this point, the set is neutralised and operational.

One idiosyncracy with transformer coupled regenerative grid-leak detectors is a tendency to break out into a loud audio howl, just as the regeneration control is getting to the best point. This can easily be cured by connecting a high value resistor in parallel with the first audio transformer primary. Start with about one megohm, and try smaller values until a cure is evident.

And that's it! With a good aerial and earth connected, old timers will have no difficulty in getting the Browning-Drake to give an excellent account of itself. Newcomers should soon master the use of the regeneration control and learn how to keep the tuned circuits in line when tuning in a new signal. Increasing regeneration improves selectivity, and if the RF filament rheostat has insufficient control for very strong signals, some judicious detuning of the RF amplifier can be used. ❖

DISCOVERING VINTAGE RADIO

We still have a few copies of Peter Lankshear's very popular book, available from the Reader Information Service for $7.50 each posted.

Audio – Radio Valves & H'ware

New shipment power & pre-amp valves sockets retainers etc. Send SAE for free price/info list.

Also: parts circuits data sheets technical advice & custom construction.

Repairs to all valve equipment.

VINTAGE WIRELESS RADIO CO.

239 Australia St Newtown
NSW 2042
Ph: 02 557 2212
Fax: 02 516 3981

READER INFO NO. 20

INTRODUCING OUR NEW BUDGET RANGE VIDEO MAINTENANCE KITS MKA, MKB, MKC

MKA - Belts, tyres + Pinchroller
MKB = MKA + Idler assembly
MKC = MKB + Tensionband

FOR MOST BRANDS.
PRICE SUBJECT TO MODEL/QUANTITY

SAME DAY DISPATCH

FOR FURTHER DETAILS PLEASE SEND S.A.E. OR FAX YOUR COMPANY ORDER TO DELTA.

WE ARE PLEASED TO ACCEPT MAJOR CREDIT CARDS

CONTACT US FOR REPLACEMENT VCR - CTV AND MWO PARTS.

DELTA COMPONENTS
182 COOPER RD YAGOONA, NSW 2199
PH: 61 2 796 2888 FAX: 61 2 7963 802

READER INFO NO. 21

DRAKE

R8 WORLD BAND RADIO
100khz-30Mhz Twin VFO
5 filter Band Widths AM FM SSB

SW8 PORTABLE
500khz-30Mhz AM FM SSB
3 Filter Band Widths

BOTH MODELS WITH AM SYNC

ZRV Electronics Pty Ltd
10/29 Peel St. Eltham 3095
TEL: (03) 439 3389
FAX: (03) 439 2483

Kevin Cavanagh VK4SP
222 Brisbane Valley Hwy
Wanora Ipswich 4306
Tel/Fax (074) 643 954

READER INFO NO. 22

MARKETPLACE

FOR SALE

AMIDON FERROMAGNETIC CORES: For all RF applications. Send business size SASE for data/price to RJ&US Imports, Box 431, Kiama NSW 2533. Agencies at Geoff Wood Electronics, Sydney; Webb Electronics, Albury; Assoc TV Service, Hobart; Truscotts Electronic World, Melbourne and Mildura; Alpha Tango Products, Perth.

MOTOROLA 6805 EMULATOR: and 68705 micro programmers. Prices and data from Graham Blowes, Mantis Micro Products, 38 Garnet St, Niddrie, 3042 Phone (03) 337 1917 (A/H); ph (03)575 3349 (B/H); fax (03) 575 3369.

"THE HOMEBUILT DYNAMO": (construction plans), Brushless electric generator, 1000 watt DC at 740 RPM. A$85 postpaid airmail from Al Forbes, Box 3919-EA, Auckland, New Zealand. Phone (0011) 649 818 8967 anytime. Phillips Ferroxdure rotor magnets (3700 gauss) kit now available cut to size and magnetised.

EARLY 1950 - 1985: Microprocessor and support integrated circuits required for educational purposes - working or non working devices. Early development kits - Altair, D2, etc also of interest. Please state prices required. Send to Smokey - PO Box 583 Nelson New Zealand.

TINY VIDEO CAMERA MODULES: on PCB from 32 x 32 x 23mm. Standard 75 ohm video output - use with TV/Monitor VCR etc. Complete with Lens, Auto CCD Iris, 1/100000 Electric shutter, Low Light and Infra Red Sensitive from $199. Use for CCTV, Robotics, Surveillance etc. ALLTHINGS ELECTRONIC Ph/Fax (09) 349 9413.

KIT SPEAKERS
We can obtain any drivers worldwide
Dynaudio, Vifa, Scanspeak, Morel.
Wide range of enclosures.
Full consulting Service Available
Home Theatre Specialists
For further details contact:
Australian Audio Consultants
Box 1031, Aldinga Beach, SA. 5173
Phone or Fax on **(085) 566370**

ADVERTISING RATES FOR THIS PAGE

SMALL ADS: *The minimum acceptable size of two centimetres x one column costs only $50. Other sizes up to a maximum of 10 centimetres are rated at $30 per centimetre.*

CLASSIFIEDS: *$4 for 40 letters. Just count the letters, divide by 40, and multiply by $4. ROUND UP TO THE NEAREST WHOLE NUMBER.*

CLOSING DATE: *Ads may be accepted up to the 10th of the month, two months prior to issue date.*

PAYMENT: *Payment by cheque or money order only, plus your name and address, should be sent with your advertisement, to:*

THE ADVERTISING PRODUCTION MANAGER
ELECTRONICS AUSTRALIA,
P.O. BOX 199,
ALEXANDRIA, NSW 2015

HI PERFORMANCE SPEAKERS IMPORTER DIRECT PRICES:

8"	50W	35Hz	0.85kg	91dB/W/M	$ 60
8"	100W	50Hz	1.10kg	93dB/W/M	$ 80
10"	200W	26Hz	1.40kg	93dB/W/M	$120
12"	200W	20Hz	1.42kg	95dB/W/M	$165
15"	150W	43Hz	1.42kg	97dB/W/M	$130
4"	50W	Tweeter	25mm VC	.25kg	$ 30

ALSO 15" & 18" MONSTERS 400/600 Watt. Many others,even lower prices for Qty & Indent orders. ALLTHINGS ELECTRONIC Ph/Fax (09) 349 9413.

LENSES - HUGE RANGE: From $20. 13 to 450mm focal length. 13 to 150mm barrel diameter. Suit Cameras, Projectors etc. Also Zoom, Anamorphic, Condensor & Mirror Backed. Elliptical & Front Surfaced Mirrors suit Lasers etc. ALLTHINGS ELECTRONIC Ph/Fax (09) 349 9413.

68705 DEVELOPMENT SYSTEM: In Circuit Simulator / Emulator and programmer board. Supports all 68HC705 range including C4, C8, J2, K1, P9, C9, D9 & 68705P3, U3, R3 micro controllers. For more information contact Oztechnics, PO Box 38, Illawong NSW 2234, Phone (02) 541 0310 Fax (02) 541 0734. Email oztec@ozemail.com.au

KIT REPAIRS - R & D, prototyping, repairs to electronic equipment, all kits repaired.
CAMPAD ELECTRONICS
26 KEITH STREET, CAPALABA, Q. 4157.
Phone (07) 245 2008

Printed Circuit Board Manufacture
We manufacture high quality PCBs at prices so low, that it's not worth making yourself!
INSTANT PCB's
P O Box 448 Avalon 2107
Ph (02) 974 1189 Fax (02) 974 5491

UNUSUAL BOOKS: Electronic Devices, Fireworks, Locksmithing, Radar Invisibility, Surveillance, Self Protection, Unusual Chemistry and More. For a complete catalogue, send 95 cents in stamps to: VECTOR PRESS, Dept E, PO Box 434 Brighton SA 5048.

MONITOR HARDWARE SIGNALS: a change takes place, a two chip circuit programmed by you in Basic uses a cheap 2400 modem to dial an Alpha-Numeric pager and leave a Numeric Message. You can even "Ring In" from any phone for an instant report. It's Don's Basic Stamp, Promo Disk $2. Don McKenzie, 29 Ellesmere Cres, Tullamarine 3043.

WEATHER FAX PROGRAMS: For IBM XT/AT's *** "RADFAX2" $35, is high resolution, shortwave weather fax, morse & RTTY receiving program. Suitable for CGA, EGA, VGA, & Hercules cards. Needs SSBhf radio & RADFAX decoder. *** "SATFAX" $45, is a NOAA, Meteor & GMS weather satellite picture receiving program. Needs EGA or VGA, & "WEATHER FAX" PC card. *** "MAXISAT" Version 2.2, $75 is similar to SATFAX but needs 2MB of expanded memory (EMS 3.6 or 4.0) & 1024x768 SVGA card. All programs are on 5.25" or 3.5" disks (state which) + documentation, add $3 postage. ONLY from M Delahunty, 42 Villiers St, New Farm 4005, QLD. Ph (07) 358 2785.

OSCILLOSCOPE: Hameg HM 205 Digital storage CRO. As new condition with probes, Comprehensive manual and case. $1100.00. Phone (065) 570341.

TV Yoke Exchange
All types of Yoke Rewinds
All types of Transformer Rewinds

240V Isolation Transformers
240/110V Output for Servicing

Contact or write to:

TRANSFORMER REWINDS

Reply paid No.4,
P.O. Box 1058,
ST MARYS, NSW 2760.

Phone: (02) 833 1146 **Fax: (02) 623 5559**

MARKETPLACE

Rare editions of "Radio & Hobbies in Australia". These 19 magazines would be of special interest to people who are interested in the development of electronics. Will accept a reasonable offer. **1949** - January Vol 10 No.10 through to September Vol 11 No.6, with November Vol 11 No.8 (October and December missing) **1950** - January Vol 11 No.10 through December missing Vol 12 No. 9 (February, July & December missing). Call G.Harris, (W) 063 384 866 or Fax 063 384 827 or write to: PO Box 338, Bathurst, NSW 2795.

Revox C274 4trk reel to reel: Fully optioned Control track, Autolocator etc. Fully Serviced, beautifully kept, superfluous machine. New $11000, sell $6500 ring Andrew (03) 817 4566.

EPROM PROGRAMMER SOFTWARE: Updated software for project in EA Sept/Oct 1993. Software reviewed in EA Nov 1994. Now revised with completely new user interface and more features. $10 ($15 overseas) incl. P&P or upgrades $5. From the original project author: Glenn Pure, 66 Crozier Cct, Kambah 2902; phone (06) 231 6457.

ACS Decoder Boards: fully built & tested by the designer! (see EA Sept '93) $30, P/P $3. Ph / Fax (02) 587-8148 for more information.

Oscilloscope: digital sampling 4 channel 100 MHZ Hewlett Packard HP54601A with HP54658A FFT storage module user and service guides $3500 ONO. Phone (07) 801 1290.

INTELLIGENT INFRARED RECEIVER KIT: Now with 8 outputs. Use with your T.V or VCR infrared remote control transmitter to control your projects. Also available infrared transmitters, preprogrammed and learning models. Coming Soon, Economy Infrared Audio Control Kit. For details call BENETRON P/L (018) 200 108 or (02) 963 3868.

Surplus Enclosures For Sale: Betacom Aluminium Instrument Cases - with chassis & sub-panel. Half rack and full rack widths 1, 2, 3 and 4 units high. Top quality, in original unassembled packs. From $42. Lockable moisture and dustproof steel cabinets with gear plate, painted brown and beige from $80. For list of available sizes, prices and quanitities, phone (02) 533 3322 or fax (02) 534 6360.

WANTED

Freelance Broadcast Technicians wanted. Experienced in professional radio, TV stations, recording studio, film. All skills required. Join the Broadcast Maintenance Personnel booking service for access to hundreds of potential employers. Call Bryce Templeton (02) 816-1409.

90 Degree Deflection Yoke to suit Admiral b&w TV chassis type AX20Y4. Circa 1957. Ring Guy on 018 253 475.

Main PCB for TEAC CD Player PD35 MK2 (CEC355CD) or non working unit. Manual for technovision VCR model VB 52OT. Phone Brisbane (07) 265 1426 or write W.Linton, 7/26 Grasspan St, Zillmere 4034.

Copy Handbook of Filter Synthesis. Zverev, Wiley, 1970. Phone (02) 631 3490.

Made in the USA or western Europe for Audio valves, Vintage equipment and books about Valve Technology. Wai Kei Leung, Block B, 5th Floor, 7 Kweilin Street, Shamshuipo, Kowloon, Hong Kong; Fax: 852-387 5560.

Handbook/Data for visual alignment SIG/GEN made by Ratcliffe Eastwood / NSW (DCA Ident Y10/35) (Model 203). Phone (054) 41 1197. Also, valves available - see my ad in Aug/Oct Marketplace.

R.C.S. RADIO PTY. LTD.

Established in 1933, RCS Radio is the only company which manufactures and sells every PCB and front panel published in EA and Silicon Chip.

651 Forest Road, Bexley, NSW 2207
Ring (02) 587 3491 for instant prices.

TORTECH PTY LTD
TOROIDAL TRANSFORMERS
Design and Manufacture
Approved to AS3108 - 1990 & U.L. Standards
Tel: (02) 642 6003 **Fax: (02) 642 6127**

FULLY ASSEMBLED
Test Equipment kits from $119.00 all with 90 day warranty for free brouchure send name & address to:
CLEARVIEW ELECTRONICS
5 Jellie Crt Warrnambool VIC.
or Phone (055) 61 4441

An Electronics Australia publication

A Basic Guide to Colour

TV & VCRS

Two very popular series of articles, published in Electronics Australia in the late 1980's, have now been combined into a separate publication.

Students, the home handyman, even the serviceman, will find that the latest book from Electronics Australia gives a wide and comprehensive insight in the electronics involved in colour television and video cassette recording.

The author, David Botto, is a television, video and electronics service engineer with many years of 'on the bench' experience. He's also designed, constructed and maintained a wide range of test instruments.

David's wealth of experience and vast knowledge of colour television and VCR's have now been put together to give you the facts, figures and basic knowledge you need, to understand just how these entertainment machines work.

Copies of this book can be obtained by sending a cheque or money order to the value of $4.95, with an extra charge of $2 for post and packaging, to:

The Book Shop,
Federal Publishing Company,
P.O. Box 199,
Alexandria, NSW 2015

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

December, 1944

Colour Television: Joseph Ream, vice president of Columbia Broadcasting System, hopes to begin experimental broadcasting of full colour fine screen television from a New York studio in a little more than a year. His company, he says, has entered into contracts for the construction of a new type of television transmitter to be delivered within 18 months. The transmitter has been designed for ultra high frequency transmission and is to be installed at the top of the 1046 feet high Chrysler building.

It is hoped that sets capable of receiving the new type of transmission will be developed in time to coincide with the beginning of the broadcasts.

New shortwave station: A new shortwave station, the most powerful in the southern hemisphere will be opened in northern Victoria soon. The new station, which will be strong enough to transmit messages to any part of the world, will be used to counteract Japanese and German propaganda, especially in enemy occupied countries.

December, 1969

10kV thyristor: Hitachi has developed a 10kV 400A silicon thyristor, type CH99, which is believed to be the largest in capacity in the world. It is expected to find wide application with heavy electrical machinery and can be used for solid state circuit interrupters and for high tension static converters.

Commercial broadcasting: The Postmaster General's Department has received only one application for a licence to operate a commercial broadcasting station at Alice Springs.

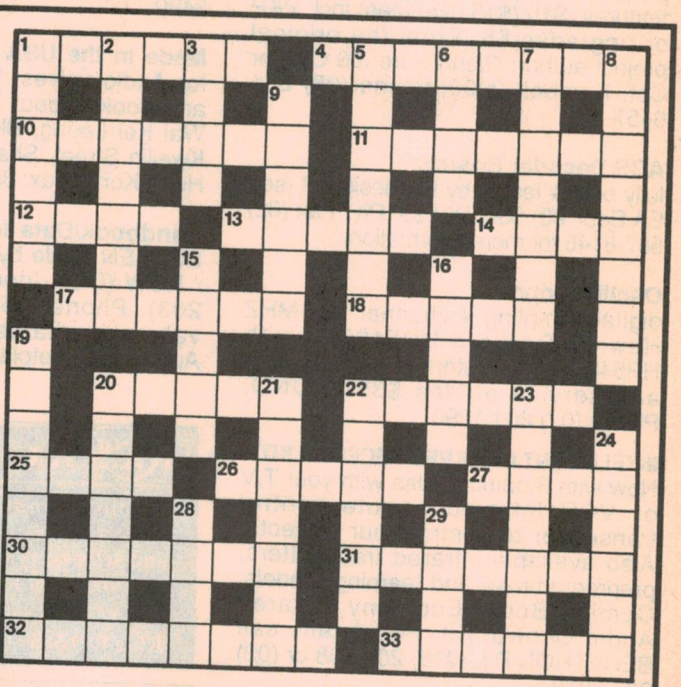
The application, from Alice Springs Commercial Broadcasters Pty Ltd, has been referred to the Australian Broadcasting Control Board which will hold a public inquiry into the application on a date to be announced.

Apollo sites: The National Aeronautics and Space Administration (NASA) has selected nine tentative moon landing sites for Apollo missions after Apollo 12. The sites are selected primarily on the basis of scientific interest. NASA plans call for a total of 10 manned lunar landing missions beginning with Apollo 11 which was sucessfully accomplished in July.

Half mile long accelerator: A half mile long 800MeV proton linear accelerator is being built in New Mexico by the University of California, USA.

Known as the Los Alamos Meson Physics Facility (LAMPF), it will produce more than 10 times the beam energy of any installation of this type now in operation. With an average current of 1mA, the highly intense proton beam will produce enormous quantities of pi and mu mesons. Over 100 Varian VacIon pumps, each rated at a speed of 600 litres per second, will be mounted along the accelerator's drift tube to provide long term ultrahigh vacuum. The pumping system will provide a working vacuum of less than 10^{-9} of atmospheric pressure.

EA CROSSWORD



ACROSS

1. Spacecraft that flew through Halley's comet. (6)
4. Fractional return of output energy. (8)
10. Said of process unlined to computer. (3-4)
11. Elastic photo scattering occurs in the —— effect. (7)
12. What has a branching network with trunk support? (4)
13. Fuses. (5)
14. Power unit. (4)
17. Space laboratory launched in 1973. (6)
18. Slow variation of performance characteristic. (5)
20. Makes a recording. (5)
22. Regions of interaction. (6)
25. Telecommunications charge. (6)
26. Inventor of the CRO. (5)
27. Linking force between atoms. (4)
30. Image. (7)
31. Camera stabilisers. (7)
32. Part of CRO circuitry. (4,4)
33. Name of hand-held Apple message pad. (6)

DOWN

1. Double images. (6)
2. Said of low demand usage. (3-4)
3. Activate (a circuit). (4)
5. Raised from ground state. (7)
6. Reduces light intensity. (4)
7. Close current carrying conductors do it. (7)
8. Branch of science concerned with motions of masses. (8)
9. Term for electronic echoing effect. 6)
15. Gradient. (5)
16. Type of camera. (5)
19. Unevenness in carburretor operation. (4,4)
20. Communications organisation. (7)
21. VDUs have them. (7)
22. Imperfect. (6)
23. Brief loss of signal. (7)
24. Thermionic emission is the —— effect. (6)
28. Outmoded photographer's item, the flash ——. (4)
29. Erase. (4)

SOLUTION FOR NOVEMBER 1994

R	A	D	I	O	T	E	L	E	S	C	O	P	E	
E		E		T		L		X		O		R		D
M	I	L	L	I	O	N		P	A	S	S	I	V	E
O		A		S		I		L		H		V		C
T	O	R	I		U	N	I	O	N		Y	A	G	I
E		U		H		O		R		B		T		B
	W	E	B	E	R		R	E	T	R	I	E	V	E
C				N		N	O	R		A				L
I	N	T	E	R	C	O	M		C	H	I	P	S	
R		Y		Y		R		E		E		R		G
C	A	M	S		S	T	I	F	F		G	E	N	E
U		P		M		H		F		I		D		I
I	T	A	L	I	C	S		E	T	C	H	I	N	G
T		N		D		E		C		O		C		E
	R	A	D	I	O	A	L	T	I	M	E	T	E	R

Electronics Australia's

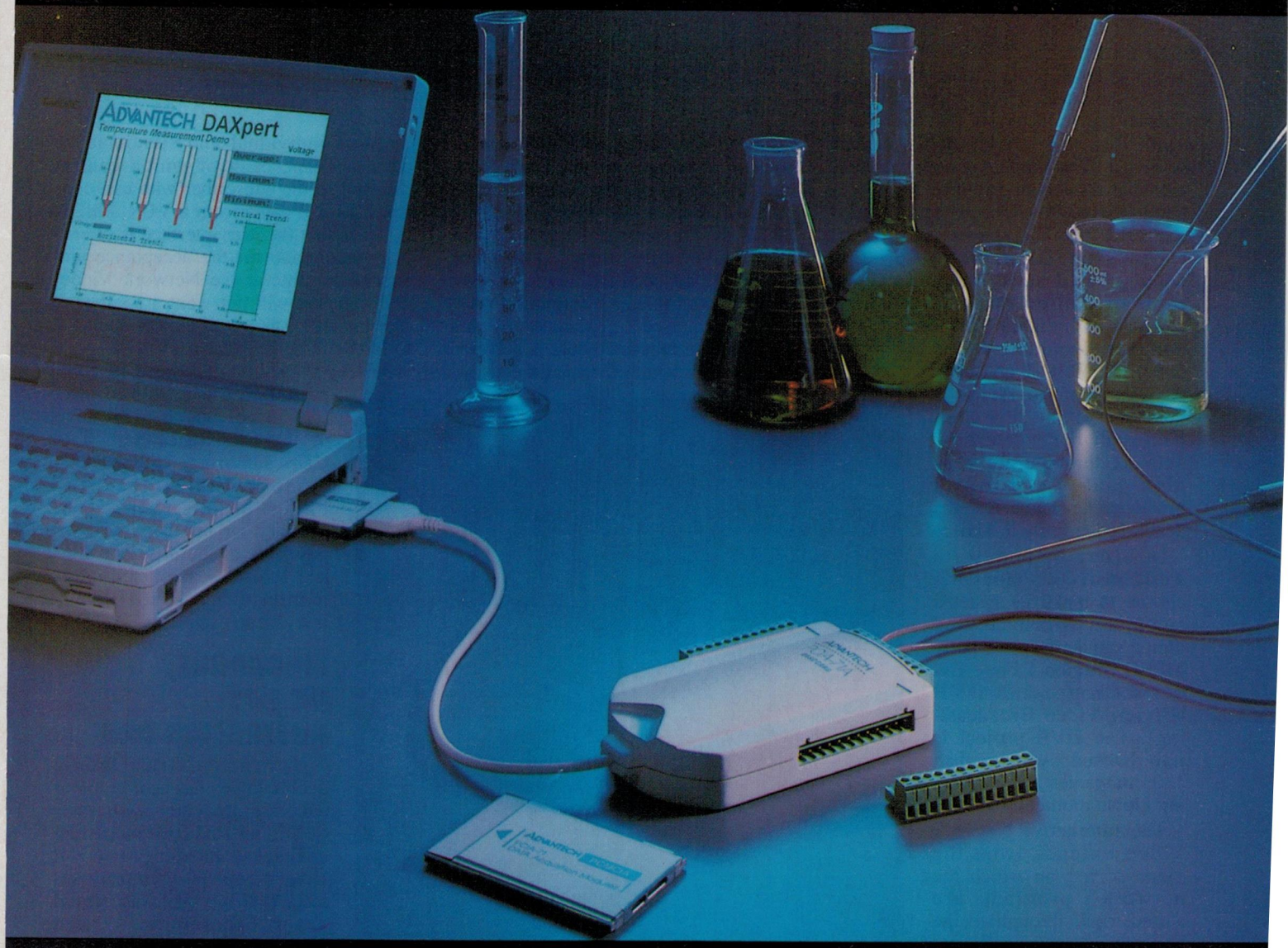
Professional Electronics

S • U • P • P • L • E • M • E • N • T

UNSW DEVELOPS SOLAR PANEL 20X CHEAPER THAN CURRENT PANELS

20MHZ DIGITAL PULSE GENERATOR BASED ON AN ALTERA EPLD CHIP

SPECIAL FEATURE ON MODEMS & DATA COMMUNICATIONS



ADVANTECH'S 'DACPAD-71' PCMCIA DATA ACQUISITION CARD & DAUGHTER BOARD COMBINATION FOR LAPTOPS: 12-BIT ADC, EIGHT DIFFERENTIAL INPUTS & SAMPLING AT 30kHz...

NEWS HIGHLIGHTS

PHILIPS REVEALS 'END-TO-END' DIGITAL TV



This year's IBC (International Broadcasting Convention) in Amsterdam saw the announcement of major Philips innovations in the fields of digital television and interactive systems.

Philips demonstrated its new and complete end-to-end MPEG-2 based Digital Video Distribution Systems for broadcast applications. Digital signals from CCETT in Rennes, France were received from the Telecom IC satellite and displayed in real time. There was also a complete uplink chain relaying signals up to Eutelsat 2Fl and back again. The high quality of the signals was seen in real time, via both commercial and consumer satellite IRDs (Integrated Receiver Decoders). A digital cable IRD was also shown.

The Video Distribution System demonstrated at IBC represents the fruits of Philips' many years of experience with digital compression technologies, including the world's first practical MPEG-1 consumer system on the CD-i platform. Philips is thus one of the few companies in the world now able to demonstrate very high quality end-to-end broadcasting using systems developed entirely in-house.

In order to penetrate world markets, Philips has chosen to make its systems compliant with emerging digital standards: principally MPEG (Motion Picture Experts Group) and DVB (Digital Video Broadcasting). The DVB project is now backed by more than 130 companies and is gaining global momentum.

The Interactive Network Video extends from the video server, on which the network's programs are stored, right through to the Customer Premises Equipment (CPE) in the form of a multimedia terminal in the viewer's home.

All hardware and software has been developed by Philips and its partners to ensure optimal connectivity and consistency of the entire platform.



At the heart of the system shown at IBC is the 'Request & Response' video server and modular storage system, containing the encoded and digitised video and other multimedia information which can be accessed on demand by subscribers. The requested data is delivered into a buffer which then releases it in a hundred individual and simultaneous data streams, each of which can be directed to the subscriber who can control it as if it came from a VCR. Philips believes that the user interface is of crucial importance for the acceptance and success of Interactive Network Video. TV watchers will not want a computer-like interface; they will expect their TV to look and behave like a TV.

At IBC Philips demonstrated its completely new and dynamic 'navigator' which uses much of the experience gained in CD-i authoring. Unlike static computer interfaces, the Philips menu screen is constantly in motion, allows previews of the different titles and can show additional information (price, actors, etc.,) relevant to each title.

SINGAPORE, HK BUY AUSTRALIAN DRB

Australian firm Ogenic Technologies has scored major successes recently with sales of Digital Radio Broadcasting equipment into Singapore and Hong Kong. The company has long realised that substantial export opportunities existed for its products, but had chosen to concentrate on the Australian market, in which it holds a 70 - 80% share.

Since becoming publicly

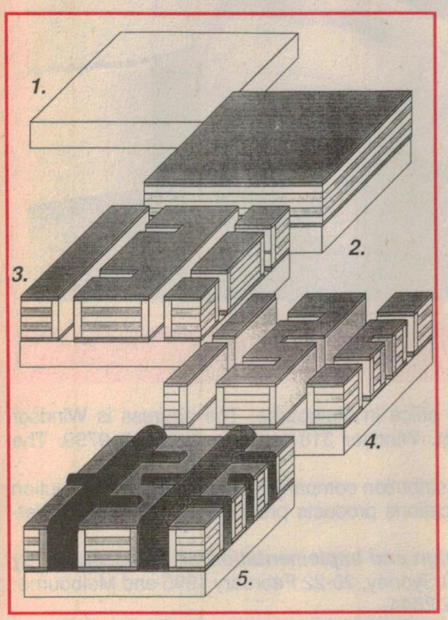
listed, Ogenic has been directing its resources towards its stated objective, to increase international marketing activity and sales performance.

This process is now well underway following the appointment of Marketing Manager Rick Dunn, who has recently returned to Australia from overseas postings in Europe and Africa.

UNSW DEVELOPS LOW COST SOLAR MODULE

Professor Martin Green and his team of researchers at the University of NSW's Centre for Photovoltaic Devices and Systems have developed an improved silicon thin-film solar module with material and production costs estimated to be about 20 *times* lower than present modules.

The new modules use much less silicon than present commercial cells, with a layer only 20 - 30 microns thick compared with 300 - 400 microns. This plus the innovative cell design used allows the use of material 100 - 1000 times poorer than the worst material presently used in commercial solar cells. The technology also allows production of a basic module 1m^2 in area, 100 times larger than at present.



The new modules are based on multiple thin layers, deposited on a glass substrate using a technique such as chemical vapour deposition (CVD). An initial dielectric layer of silicon nitride or oxynitride is followed by typically 10 layers of silicon, with alternating N-type and P-type doping; finally a silicon nitride/oxynitride capping layer is added, to form a total stack layer in the 20 - 30um range. (Although the

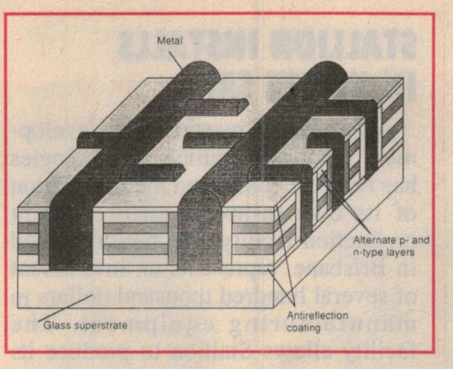


diagram shows planar layers, textured surfaces are used in practice to encourage light trapping.)

The next stage involves cutting a set of grooves in the layers using a laser, and after cleaning the edges of the grooves, these are doped (say N-type) using buried contact cell technology, as already used by UNSW and licensed to various firms. This step effectively connects all of the N-type layers within the stack in parallel.

Another similar operation cuts a second set of grooves, which are doped P-type and hence used to connect all of the P-type layers in parallel. By overlapping some of the N-type grooves with the P-type grooves, the interconnection system of the module can be varied and used to connect N-type and P-type grooves together, and hence connect selected areas of the module in any desired series-parallel arrangement.

Finally, the grooves with their doped edges are filled with metallisation — which not only performs the role of the normal contact/collection 'fingers' familiar from conventional solar cells, but in this case also provides the automatic interconnections between module areas. A transparent rear cover of Tefzel or similar material is then laminated to the rear of the module, to seal it — and also allow it to respond to light incident on either surface.

Tests have shown that this multiple-thin-layer construction allows high efficiency cells to be produced using low quality silicon, with carrier defect lifetimes hundreds of times shorter than the material currently used in commercial solar cells.

All of the innovations embodied in the new UNSW modules are the subject of patent applications.

WINNER OF FREE SUB AT QLD EXPO

Visitors attending the Federal Publishing stand at the recent Queensland Computer Expo in Brisbane were invited to enter a draw, with the winners to receive free 12-month subscriptions to the magazine of their choice.

Lucky winner of the draw for a subscription to *Electronics Australia* was Mr Jeff Smith, of Rum City Electronics in Bundaberg. Our congratulations to Mr Smith, whose free subscription begins next month with the January 1995 issue.

SMA SCRAPS CB, HANDPHONE LICENCES

About 3/4 million CB radio and handphone users across Australia have received a pleasant surprice — licence fees for CB radios and handphones were scrapped from October 3. A new class licence system, introduced by the Spectrum Management Agency (SMA), has replaced the existing system of licensing individual CB radios and handphone equipment.

Class licensing removes the requirement for each transmitter to be individually licensed — saving the operator $18 for each CB radio or handphone. Truck drivers, businessmen, bush fire brigades, farmers and sporting bodies across Australia will all get the benefits of the saving.

A class licence is an open, standing authority allowing anyone to operate a CB radio or 27MHz handphone provided the operation and the equipment itself conforms with the conditions of the associated class licence. CB and handphone users do not need to apply for the licence; they are covered automatically.

But class licensing does not mean that the use of CB radios will be deregulated, according to the SMA.

Alan Jordan, of the SMA's Compliance and Licensing Directions Team, explained that the emphasis will still be on ensuring that the equipment is operated in accordance with the requirements of the licence.

"The class licensing conditions still place an obligation on the operator not to cause undue interference, harass others or use offensive language. Under class licensing, the conditions applicable to CB and handphone operation will be essentially the same as those imposed under the individual apparatus licensing system," he said.

These conditions included the requirement to use approved equipment and limitations on transmitter power and the frequencies on which those transmitters operate.

CB repeater stations are not covered by the class licence and still require individual licensing as before.

NEWS HIGHLIGHTS

ALCATEL AUSTRALIA's PHONES FOR HK

Alcatel Australia hs received another significant export contract from Hong Kong Telecom (HKT), this time for the supply of the company's standard telephone, the Alcatel 2720.

The initial order for this phone, valued at $1 million, was won against fierce competition, particularly from the highly competitive Chinese players in the market. The Alcatel 2720 telephone will become the standard rental phone for HKT's residental and business customers. It complements the Alcatel 2740 advanced network services phone already supplied to HKT, who recently launched it in Hong Kong to support its 'Starline' and 'Citinet' services. Alcatel is now providing both high end and low end terminals for the customer's growing range of network services.

"This export success is of special significance as it confirms the excellence of our Australian quality and design," said Michael Lamb, Alcatel Australia's Manager-International. "The Alcatel 2720 telephone is based on the Touchfone 200, which Alcatel supplies to Telecom Australia. For HKT, we developed a diverse colour range to appeal to the Hong Kong community, and added Chinese characters to dedicated keys for Call Waiting, Call Back, IDD, Redial and Store functions," he continued.

The 2720 has already been exported to numerous countries in the Asia-Pacific and Europe, including Singapore, Malaysia, New Zealand, Papua New Guinea, Western Samoa, Austria, Hungary and India.

STANILITE IN US TRUNKED DIGITAL RADIO

Sydney based Stanilite Electronics is one of four companies that have successfully negotiated the cross-licensing of advanced digital wireless communications technology in the USA. The other participants were US companies Motorola, BK Radio and Transcrypt.

The agreement is a critical part of the development of the APCO-25 standard for digital trunked mobile radio. The emerging standard is the result of a special project of the US based Association of Public Safety Communications Officials (APCO) and a number of telecommunications manufacturers. It is expected that APCO-25 will become the

STALLION INSTALLS IN-HOUSE SMT

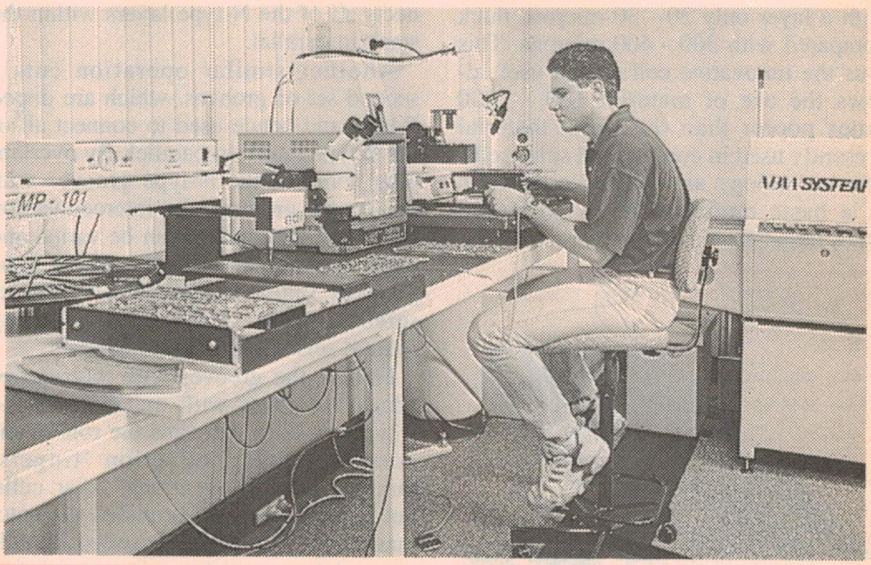
Australian IT research and development company Stallion Technologies has recently completed the installation of its own in-house surface mount production facility. The facility, based in Brisbane, represents an investment of several hundred thousand dollars in manufacturing equipment. The facility allows Stallion to produce its own pre-production and small-run production circuit assemblies.

According to Stallion's director of business development, Mr Tony Merenda, the new facility will allow Stallion to seek out more niche business opportunities.

Stallion currently contracts a number of Australian, American and Asian manufacturers to produce its range of communications controllers. The in-house facility will not supplant any of Stallion's existing manufacturing arrangements, but will only supplement them for small production runs.

The facility includes four stations. Firstly, a stencil printer station is used to apply solder paste to blank printed circuit boards. Secondly, an SMD pick and place assembly workstation enables precise placement of chips on the circuit boards. Then an infra-red reflow oven fuses the solder to the chips. Finally, an SMD hot gas rework station allows for precision reworking of circuit boards and also enables exact placement of large chips.

The manufacturing facility went on line early September, when Stallion produced the initial 200 units of its MicroChannel based EasyConnection 8/64 multiport host adaptors.



NEWS BRIEFS

- ***Wedgetail Technologies*** has opened a new office in Melbourne. The address is Windsor Business Centre, Level 2, 3 Wellington Street, Windsor 3181, phone (03) 510 9799. The company distributes Schlumberger products.
- ***1World Systems***, a newly formed Australian distribution company has secured the distribution rights to a range of networking and communications products previously distributed by Net-Comm.
- ***A three day training course called LAN Design and Implementation*** will be conducted by Independent Information Technology Training at Sydney, 20-22 February 1995 and Melbourne, 5-7 June 1995. For more details phone (02) 252 2844.
- ***Advent***, a development capital investor in unlisted Australian companies, has invested $6M in Tech-Rentals, to acquire a 49% shareholding. Advent will be represented on the board of the company.
- Peter Jarret has been appointed manager of the recently opened NSW and ACT operations of ***Data Electronics***. This Australian owned company designs and manufacturers the Datataker range of data loggers.
- ***A three day training course called Advanced PC Troubleshooting*** will be conducted by Independent Information Technology Training at Sydney, 8-10 March 1995 and Melbourne, 22-24 March 1995. For more details phone (02) 252 2844.
- ***Electronic Development Sales*** has been appointed Australian distributor for the Xuron Corporation of Saco, Maine in the USA.
- Mr David Hill, General Manager of ***Motorola Semiconductors*** has been appointed a director of Motorola Australia, bring the total number of board members to four.

standard of choice for mission-critical telecommunications applications, such as emergency services.

As one of the project's key objectives is to develop an open standard, a central element of the development process was the cooperative cross-licensing of certain elements of the APCO-25 technology. Stanilite, which has been active in Project 25 since 1991, is the only company from outside the US out of the four participating in the Agreement. According to ACPO president Steven Proctor, "[the agreement] brings Project 25 one step closer to its final conclusion." He complimented the four companies for their support, which he said has contributed towards the standard's non-proprietary future.

Mr Proctor observed that the emergence of an open digital standard will 'break the hammerlock that proprietary systems have in the analog environment."

In Australia, the emergence of the APCO-25 standard is already generating a great deal of interest at State government levels. The NSW Government Radio Network is already committed to adapting the new digital technology, while the WA Police have requested proposals for an integrated command, control and communication system based around APCO-25.

RAMTRON WINS $22M CHIP ORDER

Ramtron International Corporation, the Australian founded, US based semiconductor manufacturer will provide $22.3 million worth of high performance memory chips to Hong Kong based Ocean Office Automation Ltd, for use in a new personal computer product that marks a dramatic shift in how personal computer systems are designed.

The order, Ramtron's largest to date, is for high performance enhanced dynamic random access memory (EDRAM) chips — claimed to be the world's fastest DRAM memory. Ocean is using the EDRAM to configure computer motherboards that implement a revolutionary memory architecture named 'DynamiCache' that is four times faster than any other currently on the market. A pre-production run of motherboards are being shipped to selected customers this week, with full production starting in mid-October.

Ramtron said that more than 100,000 chips were shipped to Ocean in late September, and several hundred thousand more chips were scheduled to be shipped by the end of 1994. The remaining units will be shipped to Ocean beginning in January, and it is expected that the order will be completed during the early part of 1995.



Videolab Sydney has taken delivery of the 100th Digital Betacam VTR in Australia, a Sony DVW-A500P. The first Digital Betacam system at Videolab, the new Sony VTR has been installed in their central machine room and may be accessed from anywhere in the facility via a network of tie lines.

Using Ramtron's chips, Ocean has redefined the way in which PC memory works internally. The key to Ocean's motherboards is a wholly new memory architecture that enables the PC's entire memory bank to operate at the same speed as its processor. Ocean will be the first company to mass produce this achievement, which is expected to make PCs using Ocean's motherboards the fastest in the world today.

"We have designed this motherboard for the arrival of new operating systems like Chicago, Daytona and the new OS/2. Because such systems are memory-intensive, they are going to benefit most from the DynamiCache memory architecture," said Eddy Tsang, CEO of Ocean. "We expect to generate up to a 400% memory performance increase over that of traditional cache-plus-DRAM designs."

FUJITSU SUPPLIES OPTUS MICROWAVE SDH

Fujitsu Australia has been awarded a 'preferred supplier' contract by Optus, for digital microwave radio systems that will extend the range of Optus' national fibre optic communications network — a deal that Fujitsu believes could be worth more than $12 million over the next 18 months.

Under the agreement, Fujitsu will be prime contractor for the complete systems, responsible for the commissioning and integration of all third party equipment.

Optus' 'superhighway' already connects most capital cities via an optical fibre SDH (synchronous data hierarchy) trunked network, with transmission equipment provided by Fujitsu in its role as a Strategic Supplier to Optus. However, the terrain between cities such as Hobart, Cairns and Launceston, Cairns and Rockhampton challenged Optus to find a more flexible and efficient point-to-point communications link technologies.

Following an extensive evaluation, Optus selected Fujitsu's SDH microwave radio systems. This sophisticated, innovative technology was developed by Fujitsu Australia to meet the demands of long distance and high capacity transmission services where fibre is not economical, while retaining the intrinsic benefit of SDH technology, such as comprehensive network management and the ability to easily drop and add circuits at intermediate sites en route.

The SDH microwave radio systems will link a new digital telephone exchange in Launceston with Optus' satellite earth station in Hobart. ❖

DIGITAL PULSE GENERATOR USING AN ALTERA EPLD - 1

Erasible programmable logic devices or 'EPLDs' are finding increasing use in the design of digital systems, and are largely supplanting low-level TTL and CMOS integrated circuits. This is the first of two articles providing an update on the operation and use of EPLDs, and presenting a low cost pulse generator design based on an Altera EPM7064 device.

by DAVID N. WARREN-SMITH

Electronic circuitry is conveniently classified into analog and digital. Analog circuitry, including audio and RF etc., is well catered for with inexpensive test equipment such as test oscillators, function generators, oscilloscopes, etc. to assist the home experimenter with his projects. The digital experimenter on the other hand is not quite so well provided for.

A function generator can provide square wave pulses, but will typically have an adjustable output voltage of fairly high impedance which is not suitable for driving digital circuits. A basic piece of test equipment for the digital experimenter is a pulse generator with adjustable pulse rate and adjustable mark to space ratio, which supports an output suitable for driving TTL or 5V CMOS digital integrated circuits.

This article and that which follows it describes a small inexpensive pulse generator, which supports a very wide range of pulse rates and adjustable mark to space ratio also over a very wide range. The pulse generator is driven by a crystal oscillator module and consequently all pulse outputs have the same accuracy as the crystal oscillator module itself. The pulse generator can also operate in a one-shot mode, either through the use of START and RESET pushbuttons mounted on the unit, or through an externally applied trigger pulse. The unit to be described is completely self contained on a small printed circuit board, with all necessary controls on the board.

Full details of the pulse generator will be given later. However to get some idea of the capabilities of the unit, consider the following: The maximum frequency of the crystal oscillator module that can be used in the pulse generator is 20MHz. The pulse generator is therefore capable of a resolution of 50 nanoseconds, which is the minimum pulse width and also the minimum gap between pulses achieved by the unit.

Through the use of divider circuits the maximum pulse width and gap between pulses is 25.6 seconds, when the 20MHz crystal oscillator module is used. This means that in the extreme case the pulse generator can deliver a 50ns pulse with an interpulse gap of 25.6 seconds. The pulse generator could therefore also be used as a precision timing device with the addition of a relay driver circuit. The resolution will however be less for the longer pulses or gap between pulses, as described later.

The photograph shows a relay being driven through a power MOSFET for the purpose of observing the response and contact bounce of the relay, on an analog oscilloscope. Either the MOSFET or a darlington device can be used to drive a relay directly.

The heart of the unit is an Altera Erasable Programmable Logic Device (EPLD). All of the logic circuitry for the device is contained in an EPM7064LC-15 EPLD. The remaining circuitry on the printed circuit board consists of a 5V regulator, the crystal oscillator module, an octal non-inverting buffer for input output isolation, three octal DIP switch packs for selecting operating requirements, the START and RESET pushbuttons, three LEDs for function indication display, a 16-pin header for breadboard interconnection, assorted resistors and decoupling capacitors and a small DC jack for connecting the plug pack power supply.

Part of the purpose of the project was to explore the capabilities of Altera's EPLDs and supporting software system. However, since completing prototype units, the author has made good use of the pulse generator units for testing other projects. Two prototype units were constructed initially, since a unit was required for providing pulses to test the external trigger input capability. Hence, one unit was used to drive the other unit.

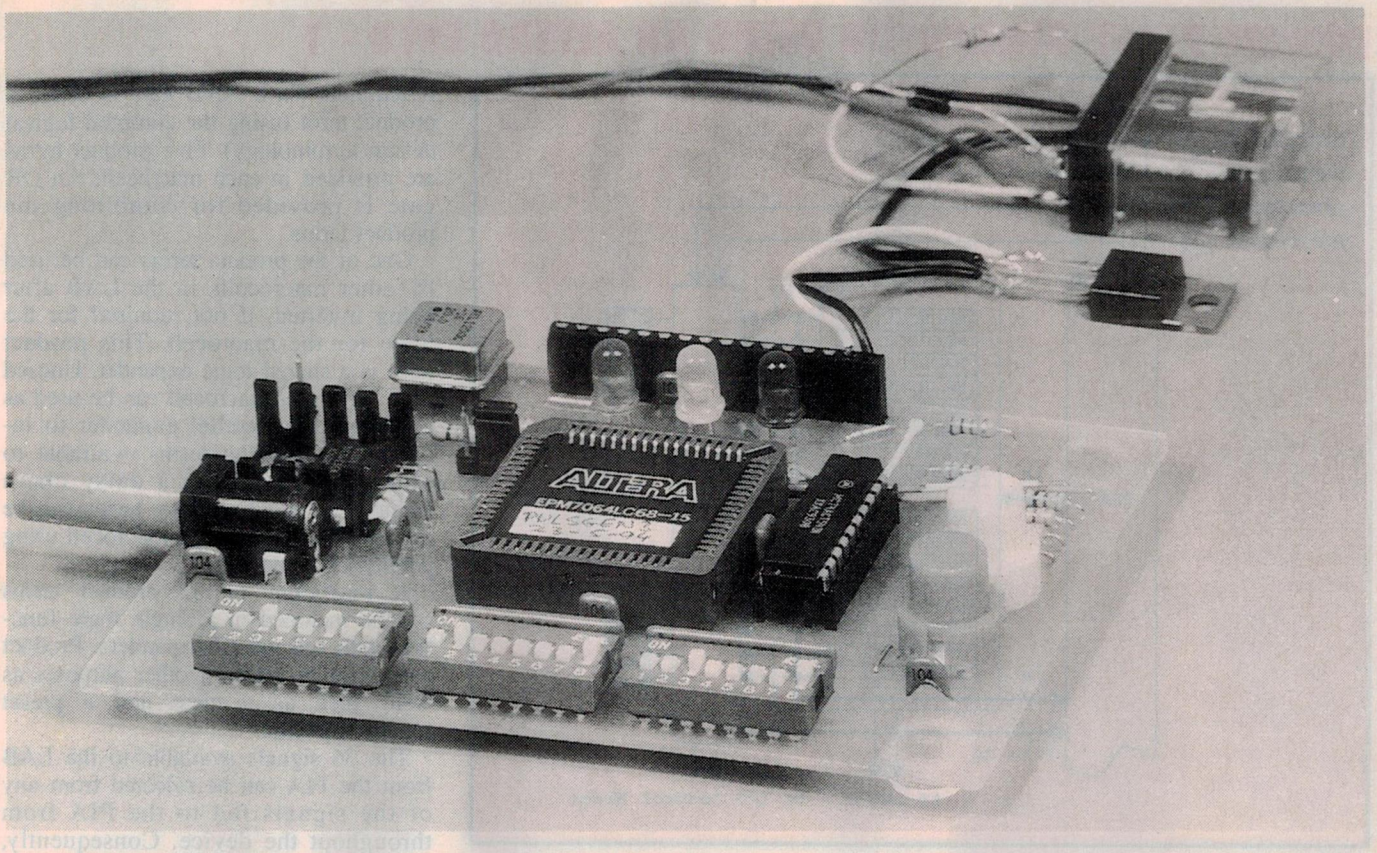
The second unit also incorporated a few small improvements and corrected a few errors on the printed circuit card. Simply by programming another EPLD, one of these units has subsequently been converted into a special purpose coded pulse-sequence generator with no changes required to the printed circuit card. This unit can be converted back to the original pulse generator simply by replacing the original EPLD.

Many readers may not be aware of the extent of developments that have taken place with programmable logic devices over the last 10 years or so. The Altera MAX 7000 series of devices will be described first, before the detailed description of the pulse generator is given. This will give the reader some idea of what is inside the device used for the pulse generator project.

It should be mentioned that there are an increasing number of companies developing programmable-logic devices, many of which have introduced powerful and innovative designs for components that are either reprogrammable or can be dynamically configured in circuit (i.e., without removing them from the system in which they are being used). The earlier fusible link devices, such as PAL devices do not have the power or necessary capability to construct projects like the pulse generator project described here.

The Altera selection of EPLD's is the one preferred by the author, due to its comprehensive development system support and the range and power of the devices available.

The cost and to some extent the complexity of powerful software systems such as the Altera MAX+Plus II system has in the past made it difficult for all but large organisations to undertake the use of these systems. However, Altera will supply (through their Australian agent) a fully featured evaluation system (with a time limit) and also have a Starter Kit called Altera's FirstStep



EPM7032 Design Utility free of charge, for potentially serious users.

The FirstStep kit with basic functionality is capable of compiling the EPM7032 device and does not have a time limit. This utility has a very good text editor and documentation in text files. Design entry is by Altera's Hardware Description Language (AHDL). Some example code is given later in this article. Several third-party EPROM programmers support programming the EPM7032.

Altera's EPLDs

Altera's EPLD product line has been under development for over 10 years and has evolved through a series of component families. The original family, now called the Classic Family has evolved into the Multiple Array MatriX (MAX) families. The original MAX 5000 family has been enhanced by their second generation MAX 7000 family.

Altera's latest family of devices, the FLEX 8000 family of Flexible Logic Element MatriX (FLEX) devices, are dynamically programmable devices (based on static RAM technology which requires a downloading of data on power up and is dynamically reconfigurable), and is more powerful again.

At the time of writing (July 1994) the MAX 7000 family are the most practical devices to use for small to medium scale projects, where cost is a factor, since these devices are being widely accepted and the price of the devices has dropped considerably. Conventional small and medium scale logic devices such as TTL and derivative devices are rapidly going out of use. These are being replaced by Very Large Scale Integration (VLSI) for mass production and by PLD or EPLD type devices and microcontrollers for small and medium scale production. Where the response of microcontrollers is insufficient, the high performance capabilities of EPLDs are a great advantage.

A brief description of the MAX 7000 devices internal structure will now be given, with sufficient detail for a basic understanding of the resources available to the designer in these devices.

Altera started their developments by researching CMOS erasable programmable read-only memory (EPROM) technology, the idea being that each EPROM cell would control a logic gate. An array of logic functions could then be controlled by an array of EPROM cells. The classic family and some of the later families were equipped with a quartz window for erasure by ultra-violet light (non-erasable 'one time programmable' parts were also available).

The MAX 7000 family, on the other hand, is available in Electrically Erasable (EE) versions. These are not only more convenient to use, since UV erasure is not required, but are also cheaper to buy, since the costly quartz window and ceramic package has been replaced by more economical plastic packages.

The organisation of the array of logic functions is significant for the logic designer. This organisation has undergone an evolution. The original classic family had some architecture limitations that made it difficult to fully use all the resources of these devices for some designs. The organisation of the later devices has substantially improved the architecture.

A modular approach has been taken for the internal organisation of the MAX 7000 devices. The basic functional units in the devices are the Logic Array Block (LAB), the Programmable Interconnect Array (PIA) and the I/O control block. The LAB itself consists of 16 logic units, called Macrocells. Each macrocell can perform a complete logic function, consisting of a flip-flop and a substantial gate array to drive it.

The gate array can be used without the flip-flop if required. Also the flip-flop has a number of configuration options available to the designer — basic flip-flop types D, T, RS, JK being supported. The PIA, as its name implies, is provided to interconnect the LABs and also to connect four global input signals to the LABs.

The I/O control blocks provide the interconnection of the LABs and the PIA

DIGITAL PULSE GENERATOR USING AN ALTERA EPLD - 1

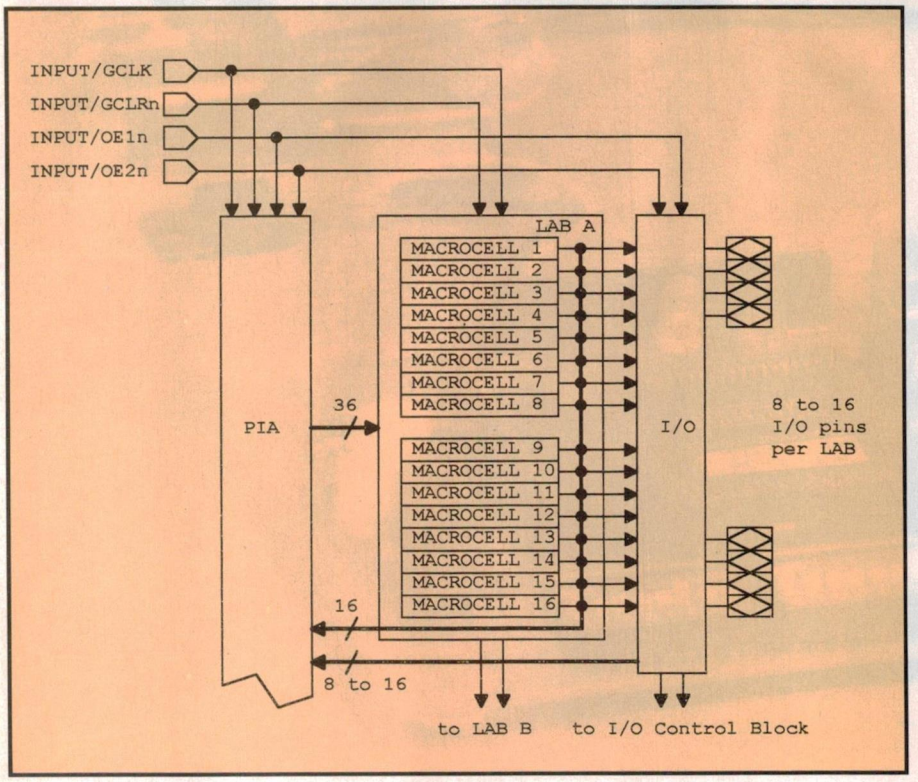


Fig.1: The overall internal architecture of the MAX 7000 EPLD device family.

to the device pins. This basic organisation is shown in Fig.1.

All members of the MAX 7000 family have essentially the same organisation and differ only in the number of LABs provided. The smallest member of the family, the EPM7032 has two LABs (32 macrocells); the next member of the family, the EPM7064 has four LABs (64 macrocells) and there is a range of larger devices up to the largest member of the family, the EPM7256E which has 16 LABs (256 macrocells).

Other devices in the range are the EPM7096, EPM7128E, EPM7160E and EPM7192E. The EPM7032 is available in 44-pin plastic quad flat pack (PQFP) and thin quad flat pack (TQFP) or J-lead PLCC packages. The other smaller devices are variously available in 68-pin or 84-pin PLCC versions and 100-pin or 160-pin QFP versions. The 7192E and 7256E are available in the larger QFP and pin grid array (PGA) versions. The range of devices available frequently makes it possible to implement a complete design in a single device, with a resulting saving in PCB layout.

The organisation of the macrocell is shown in Fig.2. On the left of the diagram is a grid of horizontal and vertical lines. The vertical lines represent logic signals. There are 36 signals from the PIA and the 36 signals from the PIA inverted. Also there are 16 signals shown as expander product terms.

Each of the horizontal lines represents an AND gate. The signals on the vertical lines are fed to each of the AND gates. The programming facility allows any of these signals to be used for any of the AND gates, allowing a very large number of inputs to the gates if required. Each AND gate is called a product term (using the common logical design terminology). Five product terms are provided in each macrocell. An OR gate is provided for combining the product terms.

One of the product terms can be used by other macrocells in the LAB after being inverted, if not required for the logic for the macrocell. This product term is a shared logic expander. Unused logic from one macrocell can be used as a whole as a parallel expander to increase the product terms available to other macrocells, in a daisy chain fashion. Up to 20 product terms can be used directly by a single macrocell using parallel expanders.

A maximum of 32 product terms can be included in a single logic function with full use of expanders. Product terms can be used for other purposes as well, such as a clear and a preset for the flip-flop.

The 36 signals available to the LAB from the PIA can be selected from any of the signals fed to the PIA from throughout the device. Consequently, there is a limit on signal availability in a LAB. This limit can generally be avoided in very complex designs by splitting up very large logic functions into smaller terms, or by assigning large logic functions to macrocells before using them in, for example, state machines or counters where they may be required in a number of logic equations. The 'fitter' module of the compiler takes care of organising the arrangement of the

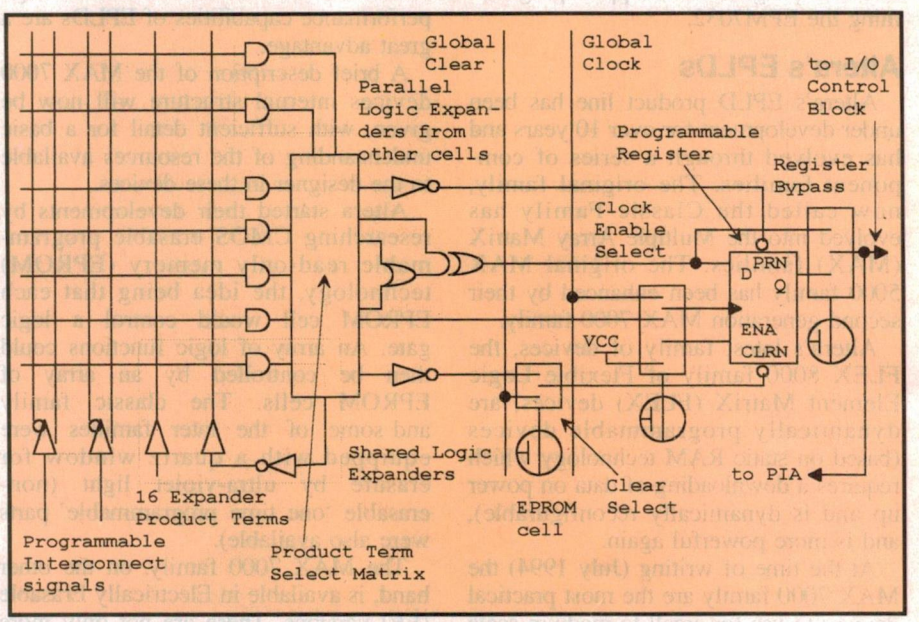


Fig.2: What's inside one of the MAX 7000 Macrocells.

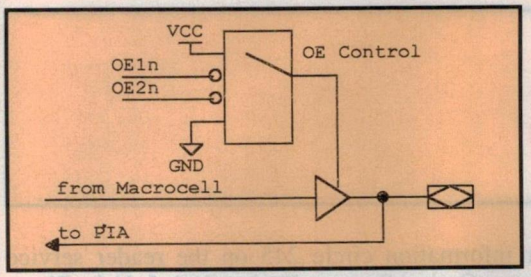


Fig.3: The logic functions inside one of the MAX 7000 I/O control blocks.

logic in the device which relieves the designer of the small detail.

Two of the global inputs are a global clock, used for synchronous designs, and a global clear. The flip-flop's clock input can also be driven asynchronously by one of the product terms. However, it is generally considered to be better practice to make a design fully synchronous if this is possible, rather than use an asynchronous clock as part of a design. The Altera MAX 7000 devices can implement asynchronous designs without the use of the flip-flops if required to do so. This is possible because of the effort that Altera has made to equalise internal delays through the PIA.

A feature of the flip-flop in the macrocell is an enable input. This is used to create a latch circuit. The latch circuit has the property that the output of the latch will follow the digital signal applied to its input as long as the latch enable signal is true. When the latch enable signal goes false, the latch holds the last value present on the input. A latch is useful for catching an input signal state. A D type flip-flop can be made to act in a similar way by use of a feed back holding term.

The output of the OR function is applied to an exclusive-OR gate. The exclusive-OR gate is used (under control of the logic synthesiser in the compiler) to invert the entire logic function if this reduces the product term requirements. The use of the exclusive-OR function by the compiler may confuse some designers trying to interpret the logic equations in the compiler report file. In some situations the designer may not wish the compiler to use the exclusive-OR function, in which case the compiler can be told not to use it.

The I/O control block circuitry for one I/O pin is shown in Fig.3. A tri-state buffer is provided for output to the pin and an input to the PIA is provided directly from the pin. The tri- state buffer can be set to be an output only, to be an input only or it can be driven directly from one of the two global output enable signals for use in bus systems. If the global output enable signal is to be driven by a logic function, this function is provided as an output signal and fed back externally to the global output enable signal.

No internal path has been provided for this function. However, this is usually not a great problem. If the device is not being used in a bus system, the global output enable signals can be used as general purpose global inputs.

The limitation of having to provide an external connection for output enable signals has been addressed with the MAX 7000E devices. (The MAX 7000E devices have some additional capabilities not shown in Fig.3.) The MAX 5000 family did not have this limitation.

Some final points are:

1. A turbo function can be turned on or off for each macrocell individually in the MAX 7000 devices. The turbo function provides a speed-power saving tradeoff feature.

With the turbo control turned off, a sleep function reduces power required to maintain the logic state of the macrocell when it is not active, saving power but reducing response time. With turbo mode turned on, the macrocell operates at maximum speed at all times.

The MAX 5000 devices applied the turbo feature to the device as a whole. The EPM7032-15T device is a low cost turbo-only version of the EPM7032 device. Portable equipment applications may be limited by the relatively high power consumption of these devices. This is partly addressed by the turbo feature. However, these are high performance devices with achievable clock speeds of 125MHz (depending on design complexity and device selected). Power consumption is not a problem for the SRAM-based FLEX 8000 devices.

2. These devices have a security feature. With the security feature turned off, it is possible to read the entire design out of the device and consequently copy it. This may be useful for investigating problems. For commercially sensitive designs, the security feature can be turned on so that the device contents cannot be copied.
3. The MAX 7000 devices have a power-up reset function built in. The power-up reset requires only that the power-up rise time meets specification. It is also a simple matter to apply a reset to any desired input with a resistor and capacitor (with suitable rise time) as is frequently done with microcontrollers if there is a special requirement.
4. The fully comprehensive and powerful support software should also be mentioned. This software supports three design entry methods, graphical, text and waveform, running under Microsoft Windows. There is a separate editor for each entry method. Each of the editors is well organised for ease of use.

The design facility is hierarchical, which means that all or any of the three entry methods can be used in a single design. There are comprehensive libraries of macrofunctions to save design time. The hardware description language supports structures for state machines and tables as well as logic equations. There is also a full timing, as well as a functional simulator, which can help the designer eliminate most logic and timing problems before the device is programmed.

A comprehensive report file is generated by the compiler. The compiler can automatically select the device for use from a specified family by default, and provide the best fit for the design in the selected device; alternatively the designer can nominate the device to use and specify the pinout and other details required. The compiler also provides a 'design doctor', which can critically analyse the design and report potential problems.

(To be continued.) ❖

VIDEO
AND
TV
FAULTS
Made Easy

Fault libraries for Australian TV & VIDEO FAULTS are available as....

Manuals $155 + $15 delivery
(inc both tv & video)

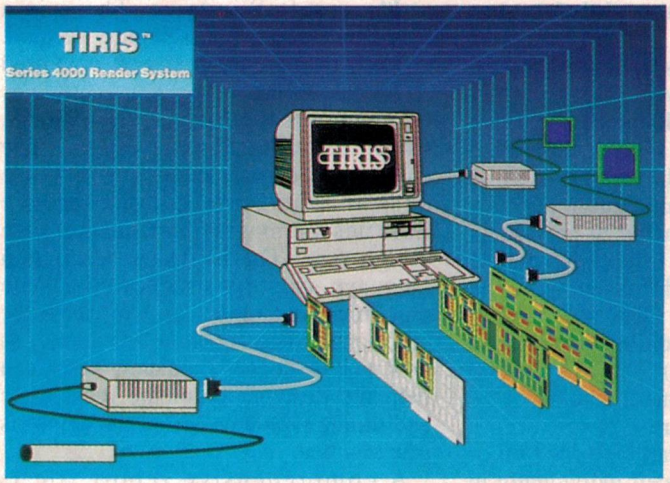
Program for IBM compatibles
$ 155 + $10 delivery

Technical Applications
P.O. Box 137 Kenmore Q. 4069
Fax / Phone 07 378 1064

READER INFO NO. 24

NEW PRODUCTS

Multiple RFID reader system



Texas Instruments has announced the release of its Series 4000 reader system, a radio frequency identification device (RFID) that supports up to 200 reading locations on a central computer. The system includes small remote RFID readers supported from AT-based 'add-on' boards that slot directly into a PC to control reading locations and provide additional I/O functions. An application can be built with a small number of read points, and then expanded without discarding any of the previously installed hardware.

Standard data transmission between read points and the central control is via RS-422 for distances up to 1.2km in a 'star' configuration. Other communication interfaces are available.

Typical applications for the system include a 'hands-free' car-park access system with multiple entrance and exit points, or a warehouse system that automatically tracks incoming and outgoing cargo pallets from numerous adjacent loading docks. The system could also be used for marathon events, where transponders are attached to runners, accurately capturing and compiling timing information.

For further information circle 243 on the reader service coupon or contact Texas Instruments, PO Box 63, Elizabeth 5112; phone (08) 255 2066.

Fibre optic modem

Optical Systems Design has announced its OSD325 fibre optic modem. The unit suits applications such as audio, data and video distribution as it has full duplex video, high quality program audio, data and 2-wire or 4-wire intercom. It also provides on- hook/off-hook signalling.

The modem normally operates over two single-mode or multi-mode fibres (one for each direction), but can be optionally supplied with a built-in wavelength division multiplexer for single fibre operation.

Applications include distribution and sourcing of lecture material, CCTV systems using the reverse channel for camera synchronisation, video/audio surveillance command systems or video conferencing.

For further information circle 245 on the reader service coupon or contact Optical Systems Design, Unit 5, Vuko Place, Warriewood 2102; phone (02) 913 8540.

GPS receiver is very small

Garmin has released a new GPS receiver, called the GPS 45. The receiver weighs around 260 grams and is about the size of a television remote control unit. It features a rocker keypad that suits single-handed navigation and plotting, as the unit fits in one hand, with the keypad buttons accessible with the thumb.

The battery life is between 10 to 20 hours and the operating characteristics are supported by the Multitrac8 system which uses up to eight satellites to compute and update the user's position at one second intervals.

Other features include 250 alphanumeric waypoints, with the nine nearest automatically available; 20 reversible routes with 20 waypoints each; 'Man Overboard' mode; plotting scales to 0.125 nautical miles and 102 selectable map datums, including Australia and New Zealand

The receiver is totally waterproof, and is enclosed in a tough rubber-armoured case.

For further information circle 246 on the reader service coupon or contact GME Electrophone, PO Box 296, Gladesville 2111; phone (02) 816 4755.

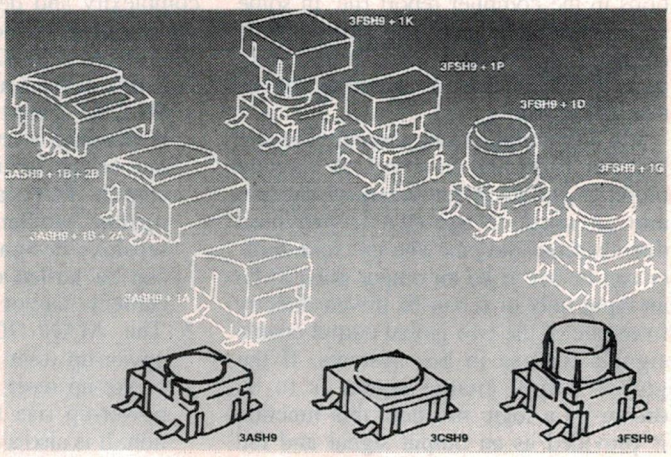
PCB connectors

Utilux has announced the availability of a new PCB terminal block range comprising two and three circuit, vertical or right angle assemblies. Based on 5mm centres, these connectors have a modular construction that allows each circuit size to be plugged together. By combining the two and three circuit terminal blocks, any combination can be catered for.

For further information circle 242 on the reader service coupon or contact Utilux, PO Box 68, Kingsgrove, 2208; phone (02) 50 0155.

Surface mount switches

The new range of Multimec miniature pushbutton switches from MEC are environmentally sealed and designed for flow, infra-red and vapour phase soldering. The contacts can be cleaned by spraying or immersing in cleaning solvents.



Each switch is 100% tested electronically, and features a 1mm key travel and an operating force of 250g. The mechanical life is specified as exceeding 10 million cycles. The recommended load is 0.5 to 50mA at 24V DC. Basic dimensions are 10.1mm square, with a height of 6.4mm.

For further information circle 248 on the reader service coupon or contact Erni Australia, Monomeeth Drive 12, Mitcham 3132; phone (030 874 8566.

Surface mount PCB tester

Huntron Instruments has introduced its latest robotic test system, the Robotic Tracker model 5500. This instrument is an analog signature analysis instrument that can troubleshoot circuit boards and surface mount PCBs measuring up to 550mm by 650mm.

The tester can work with components with a pin spacing of 0.5mm and has a probing accuracy of 0.1mm. The unit can also be connected to an IBM-compatible PC to automate the troubleshooting process.

A test routine is developed by following software prompts and entering component data from the board being tested. Video imaging puts a detailed image of the component on screen for precise pin positioning. When the position and component description are set, the tracker will probe and store digitised signatures for each test point.

While the instrument has its own probes, it has an external coaxial connector that accepts other instruments, such as an oscilloscope, a digital multimeter, LCR meter and a frequency counter.

For further information circle 247 on the reader service coupon or contact Metromatics, PO Box 315, New Farm 4005; phone (07) 358 5155.. ❖

MICROWAVE MODULES

•Self contained
•Calibrated
•Internal Antenna
•Low Power
•Low cost



•Miniature
•Lightweight
•PCB mountable
•High reliability
•Small size

This new range of Microwave Modules includes:

MICROWAVE TRANSMITTER	MTM 25	MICROWAVE RECEIVER	MRM 25
MOVEMENT DETECTOR	MDM 25	MICROWAVE SOURCE	MSM 25
DATA RECEIVER	DRM 25	MOTION SENSOR	MSU 25

LONG RANGE TRANSMITTER AND RECEIVER LRM 50 and LTM 50

These self contained modules include internal antennas and all circuitry necessary for D.C. operation. They operate at 2.43 Ghz and provide ideal characteristics for many uses including Data & Voice transmission, Security, Remote control, Traffic control, Motion detection Terrain sensing and many other applications. *Call our sales for full details.*

INTRON ELECTRONICS Pty. Ltd.
971 Mountain Highway BORONIA 3155
Tel: (03) 720 1449 Fax: (03) 720 2133

READER INFO NO. 25

ADVANCED POWER TECHNOLOGY
POWER UNDER CONTROL

Evolution doesn't always favour those who roar the loudest. So APT designed their new generation of ultra-fast diodes with the fastest switching time and the softest recovery in the business. Then they added larger die with greater current carrying capability to help make those cumbersome strings of parallel components a thing of the past.

THE ULTRA-FAST DIODE YOU'RE USING JUST BECAME EXTINCT



The results are greater density, greater efficiency and more rugged circuit designs.

APT's 600V and 1,000V devices come in a variety of sizes. Pair them with APT's own MOSFETs and IGBTs, or with components from another manufacturer. They perform beautifully either way.

Ultra-fast diodes from APT: They're what Survival Of The Fittest is all about.

SOLE DISTRIBUTORS
IN AUSTRALIA AND NEW ZEALAND

RVB

RVB PRODUCTS PTY LTD
23 Dehavilland Rd, Braeside, Vic 3195
Tel: (03) 580 0688 **Fax**: (03) 587 3532
6/220 Pacific Hwy, Crows Nest, NSW 2065
Tel: (02) 957 6385 **Fax**: (02) 929 5334

READER INFO NO. 26

Solid State Update

KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

RS-232 IC withstands 15kV

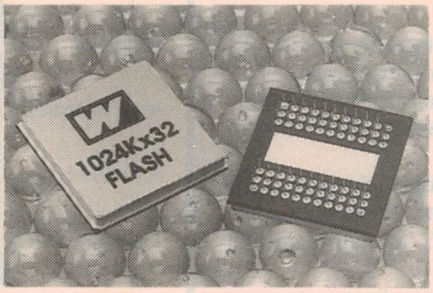
The MAX202E and MAX232E from Maxim are claimed to be the only '2x2' RS-232 ICs that are guaranteed to survive an ESD (electrostatic discharge) level of +/-15kV using IEC8012 air-gap discharge and +/-8kV using the IEC801-2 contact discharge. The devices are also immune to latchup when hit with ESD.

The devices have two RS-232 drivers and two RS-232 receivers that are guaranteed to run at a data rate up to 120kb/s. The MAX232E operates with 1uF capacitors and a supply of +5V. They are available in a 16-pin DIP, wide and narrow SO packages, and the MAX232E also comes in a 20-pin LCC.

For further information circle 273 on the reader service coupon or contact Veltec, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

1024K x 32-bit flash memory module

White Microelectronics has introduced a family of compact flash PROM 32-bit memory modules. These 32Mb devices feature a uniform- sectored design of 16 equal size sectors of 64K bytes each, which allows easy update of selected sectors, since any sector or combination of sectors can be erased and rewritten.



The WF1024K32-XHX family features low power CMOS design, TTL compatible inputs and outputs, and the devices are suited for use as high-density memory for program storage and data acquisition.

The modules are guaranteed for a minimum of 100,000 erase/program cycles and are available with access times of 100ns or 150ns. Programming voltage is 12V and the supply voltage is 5V. Standby current is 3mA.

The devices are housed in a 66-pin hex-in-line package measuring 30mm square, and are constructed on a multilayer ceramic substrate that is hermetically sealed with a welded metal cover. Their rugged construction and small size make them suited to applications where shock, vibration and space need to be considered.

For further information contact White Microelectronics, 4246 E. Wood Street Phoenix, AZ 85040.

20MHz function generator

A high-speed precision function generator IC, type MAX038 has been released by Maxim. The IC produces accurate, high frequency sine, square, triangle, sawtooth and pulse waveforms, with few external components. Each function is selected with a 2-bit digital code.

The oscillation frequency is controlled by a programmed current (2uA to 700uA) and an external capacitor. The low impedance output buffer delivers +/-20mA and the sinewave signal has a distortion of typically 1%.

An external voltage applied to the device can produce pulse width modulation of sawtooth waveforms by varying the duty cycle between 10% and 90%. Similarly, an independent control voltage can modulate the programmed frequency by +/-70%.

The internal oscillator's TTL-compatible sync output, intended for synchronising other devices in the system, maintains a 50% duty cycle, regardless of other programmed waveforms. Also, an internal phase detector allows the oscillator to be synchronised with an external TTL clock.

For further information circle 276 on the reader service coupon or contact Veltec, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

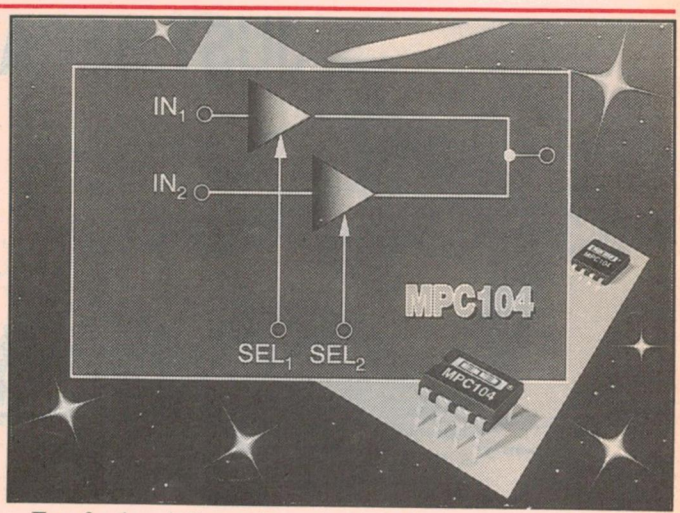
Video multiplexer

Burr-Brown has announced the MPC104, a single 2-to-1 multiplexer that distributes and routes wideband analog and digital signals. Designed to route video signals, it's also suited for other signal routing applications such as radar, communications, computer graphics, data communication (SONET) systems, data acquisition systems and professional audio signal distribution.

The IC consists of two identical high speed, open-loop buffer amplifiers with switching stages, all in an 8-pin package. Its bipolar complementary buffers form a unidirectional transmission path and offer very high output-to-input isolation.

The multiplexer allows the device to connect one of two input signals to the output. The output of the multiplexer is in a high impedance state when no channel is selected. When a channel is selected, the device acts as a buffer with high input impedance and low output impedance.

Key specifications of the device include: 210MHz bandwidth at 1.4Vp-p signal level, 500V/us slew rate, and 86dB off-channel isolation at 30MHz. These figures are for a +/-5V supply voltage.



For further information circle 271 on the reader service coupon, or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 0824.

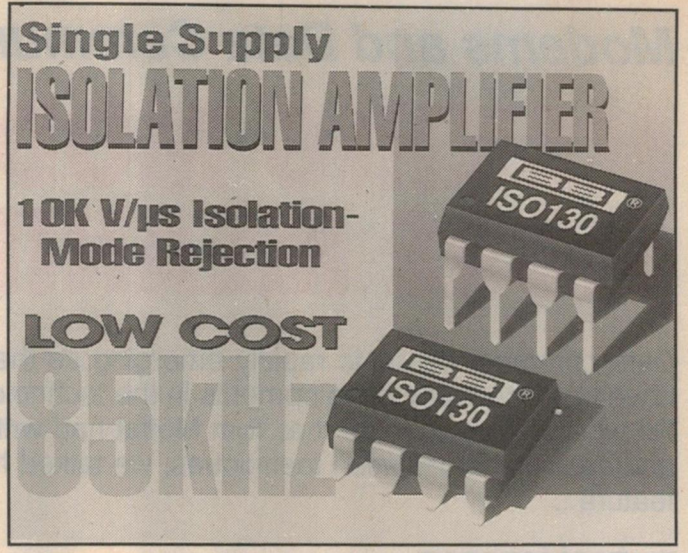
Amplifier for motor control

The ISO130 from Burr-Brown is a galvanically isolated amplifier suited for motor control applications. The device is claimed to have the precision and stability needed to accurately transmit signals across an isolation barrier under severe noise conditions, such as high-noise motor control environments. It therefore suits a variety of general analog signal isolation applications like industrial process control, motor phase current sensing, power monitoring and ground loop elimination.

The device converts analog inputs to serial digital data and transmits the signal digitally across the isolation barrier, using a high-speed AlGaAs LED. The analog signal is reconstructed on the output side of the barrier. It includes a sigma-delta analog to digital converter, chopper stabilised amplifiers and differential inputs.

Main specifications include 4.5kV AC isolation, 10kV/us isolation-mode transient immunity, 85kHz large signal bandwidth and 4.6uV/°C drift. It operates from a single 4.5 to 5.5V supply and is available in an 8-pin DIP and plastic gull-wing surface mount package.

For further information circle 275 on the reader service coupon, or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 0824.

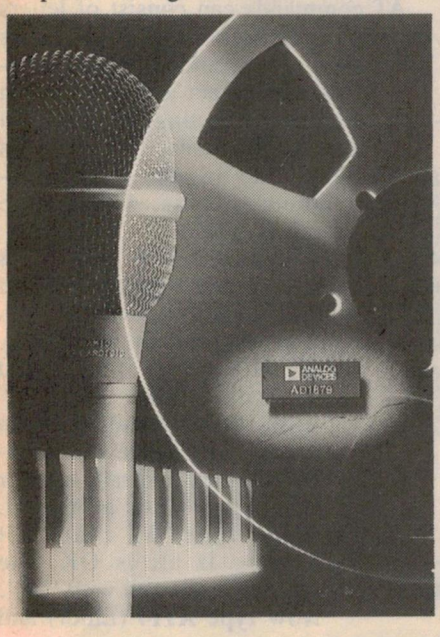


Sigma-delta ADCs

Analog Devices has announced two new sigma-delta audio analog to digital converters, the 16-bit AD1878 and the 18-bit AD1879. Input signals are sampled at 64xFs using switched-capacitor circuitry that eliminates external sample-and-hold amplifiers and reduces anti-alias input filtering.

This method preserves linear phase relationships across the passband and cuts quantisation noise. As a result, the signal to noise ratio is 103dB and the total harmonic distortion plus noise is -98dB. The input and output signals are TTL and CMOS compatible.

The devices are aimed at high-performance audio applications such as digital recording equipment, A/V digital amplifiers, digital effects machines, sound reinforcement and digital audio switchers and routers.



For further information circle 274 on the reader service coupon, or contact NSD Australia, 205 Middleborough Road, Box Hill 3128; phone (03) 890 0970.

3.3V ASICs have 750,000 gates

Toshiba has announced a new generation of application-specific integrated circuits (ASICs). All devices in the new TC200 series feature 0.4um CMOS circuitry and double or triple layer metal wiring technology.

In practical terms, this means a usable gate count up to 750,000 and a 0.19ns gate delay at 3.3V operation. In terms of performance, integration is some 70% higher and gate delay time is 20% shorter than Toshiba's 0.5um CMOS ASICs. The new series comprises three families: the TC200G series of gate arrays, the TC200C series of cell-based ICs, and the TC200E series of embedded arrays.

ASICs are highly versatile semi-custom LSIs that can be configured to meet a wide range of needs.

LCD backlighting

Unitrode has released what it claims as the first single-chip device for driving cold cathode fluorescent lamps, to backlight liquid crystal displays.

The new UC3871 synchronous resonant fluorescent lamp driver provides all the control and housekeeping of both lamp brightness and LCD contrast. Primary markets include portable computers, instrumentation, automotive dash panels and electronic signs and displays.

The device includes an auxiliary pulse width modulated controller to develop a programmable supply voltage for LCD contrast control.

When disabled, the IC draws 1uA, making it suitable for battery operation. As well, the device uses zero voltage switching and sinusoidal waveforms, to give maximum efficiency and minimum EMI generation.

The UC3871 operates from 4.5V to 20V and features an open-lamp detect circuit. This circuit prevents possible damage to the IC if a lamp becomes open-circuit.

For further information circle 272 on the reader service coupon, or contact Priority Electronics, Suite 4 and 5, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0266. ❖

WANTED
SCRAP PCB's
We will pay CASH for your scrap/obsolete PCB's containing soldered/socketted DRAM, EPROMs or CPUs
SURPLUS STOCK
all semicon's considered
Memory International
Voice: (61 2) 452 6100
Fax: (61 2) 452 6102
READER INFO NO. 27

Modems and Data Communications:

MAKING MODEMS MORE MEANINGFUL

Data communications is rapidly emerging as the fastest- growing activity of the 1990's, but there have been so many developments in the technology that often even technical people are confused. So when we discovered that Tom Moffat had written this excellent introduction to modern modems and data communication techniques, we talked him into letting us publish it as part of this month's feature...

by TOM MOFFAT

Modems were once a techno-freak's toy. But now they are an essential part of every computer — especially if you're going to 'Surf the Information Superhighway' (latest trendy term). And the current crop of modems almost universally include fax facilities that can produce images of stunning quality — certainly better than mechanical fax machines that optically scan a piece of paper to send a fax.

Modems are always supplied with fax and data software, ranging from first-class to absolutely shocking. The software is usually arranged so that the user need only type **INSTALL** or **SETUP** and the software is automatically installed upon your hard disk. You MAY have to tell it the model of modem you are using, but from then on your involvement, and your intelligence, are no longer desired.

You can use your modem to connect to bulletin boards or to send or receive faxes, unaware that your software may have been set up to the 'lowest common denominator'. The modem works, but not as efficiently as it could. File and fax transmissions are slow, but sure.

But, if you're sending something interstate over the trunk telephone network, 'slow' means 'money'. Hah — *that* got you interested, didn't it?

In this article we will investigate how the modem actually works, how the computer's software communicates with it, and how YOU can communicate with the modem to maximise its performance. Our goals are the best possible speed for a given modem, the best stability (no crashes), and 100% error-free communications.

ATtention please!

It would be fair to say that every modem on the market today works with the Hayes command set. Modem manufacturer Hayes was one of the first to produce modems that could be controlled by software commands, instead of little switches. So their system became the industry standard.

The Hayes command set relies on two basics: 'AT' commands and S-registers. Virtually every operation command sent to a Hayes-type modem must begin with the letters AT, which to the modem means 'ATtention: commands follow'. Then come the command, or commands, themselves. Your modem documentation should tell you all the AT commands your modem responds to. It may also warn that you shouldn't use them, because it's too dangerous. Piffle! Forget that. Let's go for it.

```
at&v
ACTIVE PROFILE: B0 E1 L3 M1 N1 Q0 T V1 W1 X4 Y0 &C1 &D2
&G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 &Y0 S00:000 S01:000
S02:043 S03:013 S04:010 S05:008 S06:002 S07:040 S08:002
S09:006 S10:014 S11:110 S12:050 S18:000 S25:005 S26:001
S36:007 S37:000 S38:020 S44:020 S46:138 S48:007 S95:044

STORED PROFILE 0: B0 E1 L3 M1 N1 P Q0 V1 W1 X3 Y0 &C1
&D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 S00:000 S02:043
S06:002 S07:040 S08:002 S09:006 S10:014 S11:110 S12:050
S18:000 S36:007 S37:000 S40:105 S41:135 S46:138 S95:044

STORED PROFILE 1: B0 E1 L3 M1 N1 Q0 T V1 W1 X4 Y0 &C1
&D2 &G0 &J0 &K3 &Q5 &R1 &S0 &T5 &X0 S00:000 S02:043
S06:002 S07:040 S08:002 S09:006 S10:014 S11:110 S12:050
S18:000 S36:007 S37:000 S40:105 S41:135 S46:138 S95:044

TELEPHONE NUMBERS:  0 =
                    1 =
                    2 =
                    3 =
```

Fig.1: Profiles for a Banksia PCM144F PCMCIA modem.

Nearly every modem I've tested would not work for me without my own intervention with AT commands. The reason is that manufacturers seem to assume that ALL telephone exchanges use tone dialling. Maybe so in the big smoke, but BOTH of the telephone exchanges I subscribe to studiously ignore tone dialling (as well as call waiting, call redirection, cheap Optus calls, Pizza Hut calls, etc, etc. See Moffat's Madhouse, May 1994, for a detailed grizzle).

So, for any modem to work for me, it must use old-time PULSE dialling. Happily there is a command for a Hayes-compatible modem that will do just that: 'P'. If you type **ATP** the modem henceforth uses pulse dialling, at least until it is reset or powered off. The command to restore tone dialling again is **ATT**.

AT commands can consist of letters as above, or numbers, or symbols such as &, %, \, and +. Many commands expect a number, such as when selecting one of several operating modes. If you don't enter the number, zero is assumed. That is, **ATZ** is the same as **ATZ0**.

A long series of commands can be issued together after the initial AT. If the modem accepts the commands it will reply 'OK'. If you give it an invalid command it will say 'ERROR'.

With this in mind, you can now start your data communications program and talk to your modem directly. As a first test, simply type **AT** and hit <Enter>. If all is OK, the modem will respond with 'OK'.

Now type **ATI4** (Enter) and

the modem should respond with a message telling you what its make and model is. For example, sending **ATI4** to a Netcomm PCMCIA modem produces 'AutoModem E7F V1.411-CP29Fs-1.0 (C) NetComm Limited 1994'.

Now to S-registers: These are simply storage areas for the modem's operating parameters. Most register values are placed there by the AT commands. S-registers are referred to as S0, S1, S2, right up through S200 or so in some modems. Not every modem has every S-register, and there are 'holes' in the coverage. Perhaps valid S-registers will range from S1 to S20, and then resume again at S50. It all depends on what features that particular modem supports.

You can look at the contents of any S-register using the command **ATSn?**, where **n** is the number of the register. And you can write a new value to an S-register with the command **ATSn=(value)**. For example, type **ATS0?** and you will probably be rewarded with '000 OK'. Register S0 is the one that controls the modem's automatic answering behaviour, and if S0 contains 000 the modem will not auto-answer at all. However if you now enter **ATS0=2** the modem will answer a call on the second ring.

The contents of every S-register make up what is called a 'profile' of the modem. The data contents in use at the moment are known as the 'active profile'. And now for the interesting part: Once you get the modem working just how you like it, you can store its ENTIRE operating parameters in one of two areas of non-volatile memory known as Stored Profile 0 and Stored Profile 1.

With the information thus stored you can turn off the modem, even remove it from the computer if it's an internal type. When you then re-install the modem and turn it on, the contents of Stored Profile 0 will AUTOMATICALLY be copied into the active profile. So the modem is again set up as YOU want it. You can optionally specify Stored Profile 1 to become active on power-up.

To investigate profiles for yourself, fire up your comms program so you can talk to the modem and type **AT&V**. The 'V' part means 'view', and the modem rewards you with a listing of the states of the most important AT commands and the contents of selected S-registers; for the Active Profile, Stored Profile 0, and Stored Profile 1. The modem can also store some favorite phone numbers in non-volatile memory, and these are shown at the bottom of the display. The response to **AT&V** from a Banksia modem is shown in Fig.1.

You can manually copy the contents of one of the stored profiles into the active profile with the command **ATZ0** (or **ATZ**) for Profile 0, and **ATZ1** for Profile 1. To go the other way, to write the active profile into one of the stored profiles, the command is **AT&W0** or **AT&W1**. Remember that this will zap whatever was already stored there...

Should you make a complete mess of your modem parameters by over- adventurous experimentation, you can restore the modem to the way it came from the factory with the command string **AT&F&W0&W1**. Yet another profile, the factory profile, is stored in the modem's ROM, and it can be copied to the active profile with the



command **AT&F** (for 'factory'). Then the commands **&W0** and **&W1** write the active profile, with its newly recorded factory profile, into both stored profile areas. You now have a virgin modem again.

Your modem can thus have two completely different 'personalities', perhaps to use with two different computers or at two different locations. And then there's the third, the factory profile.

This is a great system, but unfortunately it is frowned upon by modem 'experts' and writers of communications programs. This is because they want the modem to work with THEIR parameters, not YOURS. They say you should never initialise your modem with **ATZ**; instead you should let *them* do it, with the 'modem initialisation string' which is buried in the comms program.

So now it's time to break the rules. First let's look into the 'SETUP' section of your comms program to see what mischief its designers have got up to. Under 'MODEM' you should find the modem init string that is sent to your modem every time the program is started. A typical modem init string might be:

AT&FX4&C1&D2\Q3\J0\N2%C1S7=60.

You should pick through this string, command by command, to see exactly what it is doing.

The first command issued is **&F**, which scrubs your own good work out of the active profile and replaces all parameters with the factory defaults. Then come more commands:

- **X4** tells the modem to look for both dial tone and busy signals, and generate an error if they are not detected. X4 also enables certain call progress messages.
- **&C1** allows the modem to send the Carrier Detect control line high or low, depending on the presence of carrier from the other end. Otherwise the modem just pretends there's carrier there all the time.
- **&D2** tells the modem to hang up the connection if the computer drops the DTR (data terminal ready) signal line. This hardware method is preferred to the alternative hang-up, which is the **ATH** command. In many modems, taking DTR low and leaving it there will turn off the power.
- **\Q3** enables bidirectional hardware flow control using the RTS (request to send) and CTS (clear to send) control lines, as described below.
- **\J0** prevents the modem's serial port from changing its speed to match the speed at which the modem-to-modem connection has been established.
- **\N2** selects 'reliable mode' in which error correction is performed by the modem at each end. Should the distant modem refuse to cooperate, your modem will hang up.
- **%C1** enables MNP5 data compression, but not v42bis. See below.
- **S7=60** adjusts the time the modem waits for carrier after dialling. The parameter '60' here will give it a full minute to connect, which may be necessary on overseas calls.

Many of these parameters are defaults in most modems. But it's better to be safe than sorry, like the man who wears both belt and braces to make doubly sure his pants don't fall down. It doesn't hurt to issue commands that are already in effect.

Two of the commands in the

Making Modems More Meaningful

above modem init string should perhaps be changed.

You'll notice the **\N2** command tries to set up error correction, and it gives up if unsuccessful. But if you use **\N3** instead, you get 'auto-reliable mode' in which the modem doesn't hang up; it attempts a non-error correcting connection instead. My opinion is that a few errors are better than no connection at all...

Most of today's modems have two types of data compression available, MNP5 and V42bis. MNP5 can double the effective data transmission rate, but V42bis can increase it by FOUR times. The command in the above string, **%C1**, limits the modem to the MNP method. Changing it to **%C3** will enable both methods and lets the modem make up its own mind which to use.

So how does it know which to use? The process is called 'negotiation'. When a connection is first established, the two modems shoot little messages back and forth inquiring about each other's capabilities.

For example a modem calling from the USA may start with: 'Hey, man, can you do V42bis? I can do both V42bis and MNP5.' The answering modem in Australia may reply: 'No, sorry, mate. I've only got MNP5.' USA modem: 'OK, we'll have to settle for MNP5 then. What's your best speed, man?' Australia: 'I can do 14400 baud, but the line's a bit noisy, so let's try 9600.' USA: 'Not a problem, man, 9600 it is!'. All this negotiation takes place modem-to-modem without the involvement or even the knowledge of the computer.

Now that we know what's going on, we can program the modem itself to behave as we want, automatically. To do this we must take manual control of it via our communications program.

First type **AT**. Response: 'OK'; we're talking. Now type **AT&F&V**. This will restore the factory defaults to the active profile, and then display its contents for our perusal.

We will probably find that X4, &C1, and &D2 are already there. Some of the others may be in effect as well, but the modem's designers may not have considered them important enough to display. So we will program them just for good measure. Here it comes... type **AT\Q3\J0\N3%C3** and hit <ENTER>. Note that we have changed the last two items as discussed above.

If the modem responds with 'OK' you can now give the command **AT&W** to record the changes permanently in Stored Profile 0. If the modem returned 'ERROR' instead, it probably doesn't support one of the commands you sent, or maybe you made a typing error.

Now you can go back to the modem init string, scrub out all that rubbish, and simply replace it with **ATZ**. From now on, whenever your comms program starts, YOUR preferences will be loaded from within the modem itself. Also, some comms packages like to re-initialise the modem after each connection is finished, and **ATZ** will do it exactly to your own specification. And don't forget that when the modem is powered up, it will 'ATZ' itself. How very slick, eh?

You can use the same setup procedure



to produce a second set of modem preferences, perhaps for use in a second computer. In this case you change the active profile as required and then use **AT&W1** to record it in Stored Profile 1. The init string for that computer would then be **ATZ1**.

As you gain more experience, you may want to make further changes to your stored profile. Before doing this make sure you issue **ATZ** (or **ATZ1**) to transfer a clean copy of your existing preferences into the active profile. Then make your changes and save them with **AT&W0** (or **AT&W1**).

In an article like this it is impossible to give full instructions for the use of every command in every modem, but if you study your modem's User Reference you might see other things you can change to your benefit. Now we will discuss some more modem topics in general terms.

What's this MNP stuff?

Most modems of recent design use MNP (Microcomm Networking Protocol). The most important feature of MNP is *error correction*. The system organises data into blocks, a bit like packet radio, and sends the blocks along with a checksum. The other end checks the packet and the checksum, and if they disagree it asks that the packet be re-transmitted.

This procedure is known as ARQ, for automatic repeat request. The idea has been around on radio circuits for a long time. Error checking takes time, so sending via a bare-bones error correcting link is slower than by a non-error correcting link. However various 'levels' of MNP speed things up.

MNP1 uses a half-duplex circuit; it can't send and receive at the same time. Each eight-bit data byte is accompanied by a start and a stop bit and communication is asynchronous, with the receiver pausing briefly to wait for each and every start bit. After a certain number of bytes the sender has to stop and wait for an acknowledgement from the receiver. MNP1 can communicate at only 70% of the speed of a non-error corrected link, but what comes out the end is error-free. MNP1 is now totally obsolete.

MNP2 introduces full duplex operation, so data can follow one path while acknowledgements follow another. Transmission is still asynchronous. The speed rises to 84% of a non-error corrected link.

MNP3 introduces synchronous transmission. Start and stop bits are stripped off, and only the eight data bits are sent. Sophisticated measures are needed to keep the two ends in sync, but this is no problem with modern hardware. Start and stop bits are re-attached to data bytes before they are presented to the computer on each end, so the computers still see the asynchronous communication they are used to. Because fewer bits have to be sent, effective speed rises to 108% of a non-error corrected link.

MNP4 is like MNP3, but in addition it is able to monitor the line quality and adjust the length of the packets it sends. If the line is clean it sends bigger packets, but if too many repeats are being called for, it makes the packets smaller so it takes less time when a re-send is

required. The effective speed of MNP4 rises to 120%.

MNP5 adds data compression. similar to the method used to produce 'ZIP' type compressed archive files. This is done on the fly, with the modem hardware on the sending end compressing the data, and the receiving modem expanding it out again.

The computer still sees the data as a stream of asynchronous bytes, but now they are coming through at up to twice the rate that the line speed would indicate. That is, a 2400 baud connection could be running at an effective 4800 baud.

The speed depends upon the 'compressibility' of the data, with straight text receiving the most benefit. COM type files are not so fortunate, and sometimes trying to send an already-compressed .ZIP file will actually reduce the speed below that of MNP4, since the modem is trying to compress data a second time.

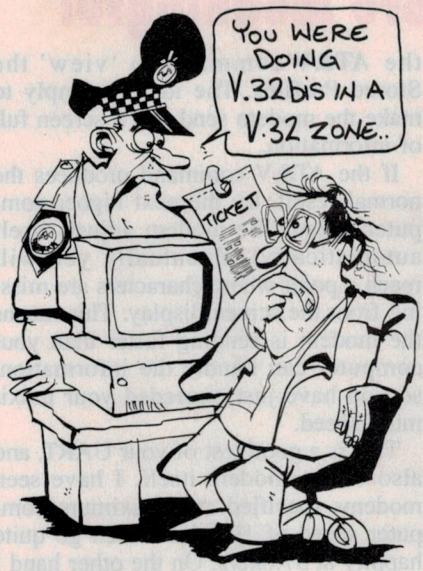
There are more MNP levels, but we won't detail them here because none of them seems to appear in current modems. However MNP10 is worth mentioning; this level can actually change the line speed of the connection to cope with varying line quality. Its primary purpose is with cellular telephones, which can fade in and out. MNP10 is also useful on shaky overseas lines, allowing a connection to continue which would otherwise bomb out. Some of the latest PCMCIA modems have MNP10, along with special interfaces to connect them with cellular phones.

European connection

MNP doesn't have the game to itself. The Comite Consultatif... — oh, you know, the CCITT — has some standards of its own. These are somewhat newer, and from my experience, they seem to be better. LAP-M (Link Access Procedure for Modems) is the CCITT's answer to MNP. The CCITT standard **V.42** specifies LAP-M as the primary error-correcting protocol, with fallback to MNP if it fails (such as if the other modem doesn't do LAP-M). If your modem gives you a choice of V.42, use it!

As for data compression, the CCITT option is **V.42bis**. This is similar to MNP5 but twice as fast, allowing effective speeds of four times the line speed. Choose V.42bis if at all possible, as discussed above with the modem init string.

Now for an important point: To make full use of V.42bis, you should set your



computer's communication speed to FOUR TIMES the highest line speed your modem is capable of. So if you have a 14.4kb/s modem, you should use a computer speed of 57.6kb/s. If you're sending or receiving an easily-compressible file, you may have data transferring this fast. Should you not be able to achieve 57.6kb/s with your computer, you can select a lower speed and it's no big deal. It just means you can't use V.42bis to its best advantage.

V. numbers, speed

All this 'V.' stuff is certainly confusing. Why don't they just specify modem speeds? Instead of introducing a long and convoluted table, let's just mention the 'important' V. standards:

V.22bis is 2400b/s. This is the slowest modem you should contemplate buying nowadays, and it should come good and cheap. Some online services will no longer allow you connect below 2400b/s.

V.32 is 9600b/s, a good mid-range modem speed. Again, this is becoming fairly obsolete.

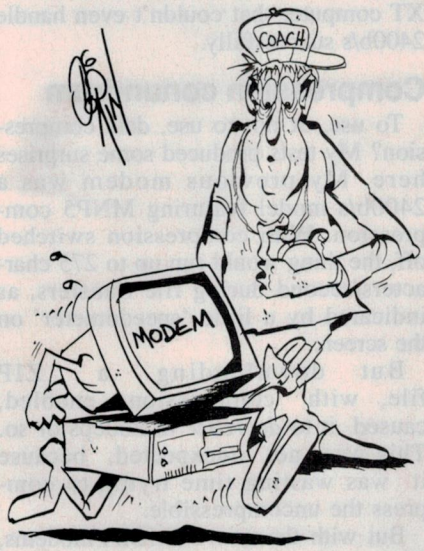
V.32bis is 14.4kb/s. This is the highest common speed at the moment and if you're after the latest in modems, this is it, for now.

V.Terbo is an improvement on V.32 to give 19.2kb/s. It will probably be superseded by V.34.

V.Fast is a standard being promoted by some manufacturers to reach speeds of 28.8kb/s. It MAY become the official V.34 standard, and then again it may not...

V.34 is waiting in the wings. The standard is NOT yet ratified, but it is expected to provide speeds up to 28.8kb/s. It may or may not be compatible with V.Fast and V.Terbo.

Note that modems rated for a particular top speed will generally connect with modems of lower speed, at the slower modem's speed of course. By the way, the 'bis' part of any CCITT specification is simply a Latin suffix meaning the 'second' version of a standard. If you see 'ter', as in V.27ter (4800b/s fax), it means third.



Flow control

Consider the situation when data compression is disabled; for instance if the remote modem is incapable of doing compression. Yet nobody's bothered to tell the computer of this fact, so it's still sending at 57.6kb/s. Obviously something's got to give, or the modem may explode. (No, only joking!) The incoming data will try to crowd into the modem, and finding it's already full, it will simply vanish.

So the modem must be able to tell the computer, "Hey, hang on until I get this lot sent!". This is accomplished with some signals called 'flow control'. There are two methods, software and hardware.

With software control, the modem sends a special character (called XOFF) along the receive data line to the computer, to halt transmission if the modem can't yet handle it. Once the modem is clear it sends another character (XON), inviting more transmission.

With hardware control the same thing is done over two control lines — RTS (request to send) and CTS (clear to send). Hardware flow control is much preferred, because it is fast and foolproof. Its disadvantage is that two extra wires are needed in the cable between the modem and the computer; but

these are almost always provided nowadays.

Software flow control means extra characters must be sent for every interruption of data flow. The characters are simple eight- bit bytes, so they can also appear randomly as part of the data being sent — possibly confusing the modem or computer. But if you don't have CTS and RTS lines, software flow control is the only option. An example is the Hewlett-Packard HP95LX palmtop computer, which has only incoming and outgoing data lines, and ground.

The 16550 UART

Many older, or cheaper, computers can't achieve speeds such as 57.6kb/s because their UART's aren't up to it. The UART (Universal Asynchronous Receiver-Transmitter) chip is the hardware device that collects data bytes from the computer's parallel data bus and sends them out the serial port one bit at a time, with start and stop bits added — and also takes delivery of incoming serial data from the modem, and reassembles it back into parallel bytes for the computer. The original IBM-PC UART is a chip called the 8250, and many of them find it heavy going even at 9600b/s.

The 16550 is a UART of much newer design, capable of running at well over 100,000b/s. In addition the chip has 16-byte buffers on both its input and its output, so if data is streaming in at a furious rate the 16550 can store up to 16 bytes until the computer finds time to collect them.

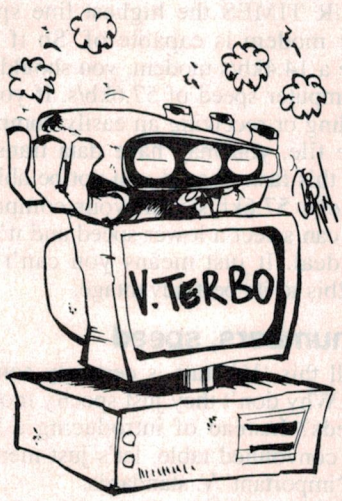
Going the other way, the 16550 signals the CPU when its transmit holding buffer is ready for more data. But the software can now send a burst of 16 bytes instead of just one byte, so it only has to attend to the UART 1/16 as often. The 16550 is particularly helpful when running Windows.

If you don't have a 16550 UART, you can easily purchase a new serial card with a 16550 on it. However if you're using an internal modem, or a PCMCIA card modem, you're pretty well stuck with what you've got. Some of the latest PCMCIA modems have 16550's on board.

What speed CAN your computer run at? One way to find out is suck it and see. Fire up your communications package and get your modem talking ('AT' — 'OK'). Then enter the setup menu and increase the computer's baud rate. Now come back to the modem and try the **AT&V** command to 'view' the Stored Profiles. The idea is simply to make the modem send you a screen full of information.

If the AT&V command produces the normal result, try the next higher computer speed (the modem adjusts itself automatically). Eventually you will reach a point where characters are missing from the screen display. This means the modem is sending faster than your computer can handle the information, so you have just exceeded your maximum speed.

This is a good test of your UART, and also of the modem itself. I have seen modems specified at a maximum computer speed of 19.2kb/s which go quite happily at 57.6kb/s. On the other hand I



once owned a serial card from an old XT computer that couldn't even handle 2400b/s successfully.

Compression conundrum

To use, or not to use, data compression? My tests produced some surprises here. My previous modem was a 2400b/s model featuring MNP5 compression. With compression switched off, the thing would run up to 275 characters/second during file transfers, as indicated by a little 'speedometer' on the screen.

But downloading a .ZIP file, with compression enabled, caused it to *decrease* to 260cps or so. This was not unexpected, because it was wasting time trying to compress the uncompressible.

But with the new PCMCIA modems, leaving the compression on produces a small speed *increase* — even though, in theory, the speed should deteriorate. I can only guess at why this is, but I suspect the new V.42bis compression method might be able to squeeze those .ZIP files just that little bit harder.

The moral of the story is, if you've got an older, slower modem, it might be best to leave compression off (**%C0**). But if you've got a new you-beaut high speed modem, try it with V.42bis enabled (**%C3**), even on .ZIP files, and you might be pleasantly surprised.

Software suggestions

In preparing this article I was able to test many communications packages. I won't mention every one, but I will point out two that I found most useful. For MS-DOS, a shareware program called *Odyssey* shines above all others, including some of the commercial packages. It is small and light and clean as a whistle, and it goes like the wind. Using *Odyssey* and one of the 14.4kb/s modems with data compression enabled, I was able to hit a transfer rate of 4625cps, between Sydney and Hobart.

As for *Windows*, another shareware package called *MicroLink* seems to come up best, although it's significantly slower than *Odyssey*. Downloading the same file as with the *Odyssey* test, from the same Sydney bulletin board, less than five minutes later, *Microlink* could only do 1248 characters per second, around a quarter of *Odyssey*'s speed. I suspect this is just the nature of *Windows* rather than a shortcoming of *MicroLink*.

MicroLink looks great on the screen, and a nice feature for PCMCIA users is a set of traditional modem status lights which appear at the top of the screen window. They actually look like the LEDs on the front panel of a modem, and they're very useful to indicate the state of 'carrier detect', etc.

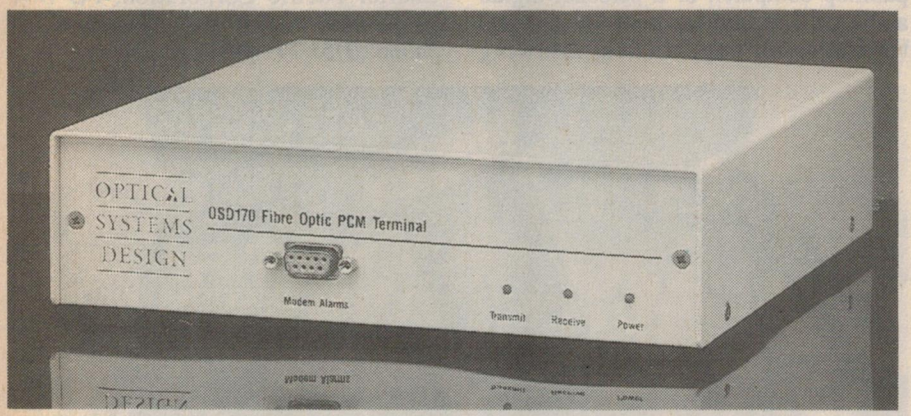
I suppose the ultimate comms program would be one that looks as nice as *MicroLink*, but runs under DOS. Then you'd have the lot — speed and beauty! Both *MicroLink* and *Odyssey* are available for download on various bulletin boards.

This article was actually written as part of a short series, dealing with PCMCIA cards and fax modems as well. Hopefully the Editor will publish the other two articles shortly. In the meantime, thanks are due to Netcomm and Banksia for their kind loan of PCMCIA modems. ❖

Special feature:

What's new in modems and data communications

PCM optical modem



The OSD170 is a low cost, high performance fibre optic PCM terminal designed for in-house links such as PABX interconnects, 2.048Mb/s data switch links and so on. It operates essentially as an analog link, optimised for the transmission of balanced ternary signals with peak amplitudes of 2.37V that will transmit any standard G.703 signal from T1 (1.544Mb/s) to E2 (8.448Mb/s) without adjustments.

In its basic form, a regeneration function is not included as in most applications regeneration will normally be provided by the customer's equipment. Operation at either 850nm or 1300nm is available; in either case sufficient power is coupled into standard 10/125pm single-mode fibre to allow useful distances to be spanned, as much as 30km at 2.048Mb/s when operating at 1300nm.

The OSD170 is available in a self-contained case which takes up half a modem tray in a standard 19" rack.

For further information, circle 201 on the reader service coupon or contact Optical Systems Design, PO Box 891, Mona Vale 2103; phone (02) 913 8540.

2km fibre optic bus extender

The Laser Link III is a transparent SCSI fibre optic bus extender which enables devices to be located up to 2km from the host computer. Laser printers, optical jukeboxes and tape back-up systems can normally be located no further than six metres from the host computer.

The extender is designed to support a new generation of high performance workstations, file servers, disks and optical arrays.

It suits critical applications that require real-time data redundancy at remote locations, as in banking and high security computer systems. It also lets users in the publishing and imaging industry place scanners and printers in secure central locations. The extender also allows SCSI-based photographic cameras to be operated remotely from the computer system.

The link supports fast SCSI data rates of 10MB/s and is completely transparent to the user. It supports any combination of asynchronous and synchronous SCSI devices. A single-ended SCSI connector on the rear panel connects to the host computer or

Phone line sharer

National Communications is now manufacturing a range of phone sharing equipment in Queensland, under licence from the US manufacturer. Called the Easy Connect range, these devices are used where a single telephone line supports a range of equipment like a phone, fax, modem and an answering machine.

The product range includes switching devices able to work with a combined fax/modem, and because the company has had many years' experience in the US, National Communications is able to offer a fix for virtually any telephone communication switching problem.

The devices are microprocessor based, and are upgradable. For instance, when distinctive ring technology (different telephone ring for each member of a household) is introduced, the National switchers can be upgraded by changing a ROM.

The devices include the Easy Connect Plus, a switcher that allows a fax modem, fax machine, modem and voice telephone to share the one line. The Scan Master allows direct connection between a fax machine and fax modem, so the fax machine can be used as a 200dpi scanner or as a printer. The



Easy Connect Pro has the features of both the above. Prices range from $299 for the Easy Connect Plus to $349 for the Easy Connect Pro.

For further information, circle 206 on the reader service coupon or contact National Communications on (075) 96 5128.

peripheral. No additional software is needed for installation and operation.

The Laser Link III external unit costs less than $5500 for two kilometres. Lower cost board versions are available for complete internal system integration.

For further information, circle 202 on the reader service coupon or contact Graphics Computer Systems, 22 Harker Street, Burwood 3125; phone (03) 888 8522.

Hayes PC modem

Hayes Microcomputer Products (Australia) has announced its Accura 14400 FAX144 for distribution in Australia. Designed for personal use in the home and small office, the data/fax modem has a recommended price of $499. It comes with Hayes Smartcom for Windows LE and Hayes Smartcom FAX for Windows communications software, and all necessary cables.

The modem is housed in a durable plastic enclosure and is a high quality asynchronous modem for data and fax communications. It supports ITU-T V.32bis for 14,400b/s dial-up operation; ITU-T V.42bis data compression; ITU-T V.42 error-control and Group 3 fax using ITU-T V.17 for 14,400b/s fax transmission. The modem also supports V.32, V.23, V.22, and V.21 as well as Bell 212A and 103.

Smartcom for Windows LE is a streamlined version of Hayes' latest communications software package for PCs. It uses the Windows graphical interface, enhanced memory management and multitasking capabilities to combine performance with ease of use. Smartcom FAX for Windows is a fully featured easy-to-use fax program designed to exchange faxes containing both text and graphics with fax machines and other fax-equipped PCs.

Available in Australia from computer retail stores, the fax/modem carries a two-year limited performance warranty. Hayes Smartcom communications software carries a 90-day limited performance warranty.

For further information, circle 203 on the reader service coupon or contact Hayes Microcomputer Products (Australia), Level 1O, 201 Miller Street, North Sydney 2060; phone (02) 959 5544.

Dataplex V.fast modem with ALRA

Designed and built in Australia by Dataplex, the Austel approved DPX-225 V.fast data/fax modem offers automatic line rate adjustment. With this feature, the DPX-225 automatically renegotiates line speed (either up or down) depending on line quality and performance. This allows the fax/ modem to transfer data at the fastest possible rate, up to 115.2kb/s with data compression.

The modem provides high throughput up to 115.2kb/s, together with V.42bis/MNP 5 data compression, V.42 error correction, system security and full fax capability. The stand-alone DPX-225 and its companion rack mount version, the DPX325, suit local or international high speed fax and data transfers over any dialed or leased line.

The fax/modem provides full send and receive fax capability with Unix, VMS, DOS, Macintosh, Windows and third party software support. It can be used with a PC or terminal to send or receive faxes at speeds up to 14.4kb/s. Digital signal processing and adaptive equalisation is used to ensure the modem delivers accurate data over all types of phone lines. Selective block retransmission, V.FC, V.42bis and MNP 5 ensure the highest possible throughput and economy.

The modem is ideal for high volume traffic on expensive long distance lines or any application where fast, low-cost error free data transfer is required. Incompressible files are sent error free at 28.8kb/s.

Password verification and same line callback help protect a system from unauthorised access. Once configured, the DPX-225 cannot be reconfigured by any interface or line commands. Autologon allows users to bypass the normal password entry sequence.

Priced at $895 (ex tax) the DPX-225-20 V.fast fax/data modem has an internal power supply and comes complete with everything needed to get started.

For further information, circle 204 on the reader service coupon or contact Dataplex, PO Box 526, Blackburn, 3130; phone (03) 210 3333.

Australian made PCMCIA modem

Charter Pacific Communications, a Gold Coast based mobile communications subsidiary of publicly listed Charter Pacific Corporation Limited (CPC) has introduced its Cellular Card, claimed as the first of its kind to be manufactured in Australia.

The PCMCIA card is a mobile modem that can be connected to an analog cellular phone, a notebook or palmtop computer, or a personal digital assistant. The card has both fax and data transmission capabilities, allowing speeds up to 14.4kb/s. Transmissions through the PSTN are also possible.

The product was developed with American-based Rockwell and can send or receive faxes, or be used as a modem.

It is independent of the type of computer or software environment and can interface with most analog cellular phones that have hands-free or data facilities and appropriate firmware.

For further information, circle 205 on the reader service coupon or contact Charter Pacific Corporation, PO Box 7557, Gold Coast Mail Centre 4217; phone (075) 741 969.



Australia's first 28.8kb/s modem under $500

Australian manufacturer Avtek Data Communications has announced the availability of a new range of high performance modems with exceptionally low price points. The new products include a high speed 28,800b/s modem for $499; a 14,400b/s data/fax modem for $299; and data/fax/voice modems from $349.

The MegaPlus Fax 28.8 is a fully featured desktop data/fax modem with support for all modem speeds from 300b/s up to 28,800b/s, (V.Fast), including 1200b/s, (V22); 1200/75b/s (V23); 2400b/s, (V22bis); 9600b/s, (v32) and 14,400b/s, (V32bis).

The modem supports full error correction (MNP4, V42) and data compression (MNP5, V42bis) providing a maximum terminal speed of 115,200b/s. The modem also supports MNP10, which is ideal for poor line conditions and cellular communications.

The new Mega DataFax 144 offers users speeds of 14,400b/s at an entry level price of just $299. New hardware technology, combined with Windows communications software Cooee v1.2, provides all data and fax communications up to 14,400b/s. Error correction and data compression is enabled in the data link via the communications software.

Avtek's new voice modems offer users fax, data and voice in the one unit. The 2400bps MegaPlus Voice and the 14,400bps MegaPlus Voice will automatically identify incoming calls as voice, data or fax and will store them accordingly.

For further information circle 240 on the reader service card or contact Avtek Data Communications, PO Box 379, North Ryde 2113; phone (02) 888 5333 or fax (02) 887 2839.

ECQ electronics pty. limited

ECQ Electronics Pty. Limited are Importers & Suppliers of Cable, Connectors, Electronic Components, Tooling & Test Equipment for the Computer, Data Communications, Electronics & Audio/Video Industry.

Australian Made Products:
Category 5 RJ45/IDC
Outlet Modules
Patch Panels
COAX Connectors Cable

Cable Assemblies- Custom Manufactuers of:
COAX Cables
Flat Ribbon Cables
Multi-Core/Multi-Pair Cables
UTP Cables

236 ARTHUR STREET, NEWSTEAD QLD 4006
PH: (07) 254 1153 FAX: (07) 254 1391
2/3 LASER DRIVE, ROWVILLE VIC 3178
PH: (03) 764 2040 FAX: (03) 746 2070
OR TOLL FREE: 1 800 777 112

Distributors For:
SHUTTLE INDUSTRIES LINK CABLES

READER INFO NO. 28

STOP

TELEPHONE LINE SHARING

New Technology – Share A Line and Save $445 in First Year

STOP

TWO YEAR EXCHANGE WARRANTY

EASY-CONNECT
PHONE – FAX LINE SHARER
Integrate your Fax (or Modem) into any Telephone System.Completely Automatic and Transparent reception, without Compromise. No special wiring, any device at any location. Your Callers will never know it's on the Line.



SCAN MASTER
FAX – FAX / MODEM LINK
At last, you can now interface your Fax with your Fax/Modem to provide Document Scanning to Your PC, Hardcopy Print to your Fax. The only fully automatic device on the market



New Products Just Released

EASY-TRANSFER
Low Cost Single Line PABX Just Plug it in and create Two Extensions, on ANY LINE. Plug in another for Two more. Works with your normal telephones.

MUSIC ON HOLD for Single Telephone Lines

RING MASTER
Low Cost PABX for Demos, Training, Service

FMX
FAX - MODEM LINE SHARER
Now you can connect your Modem to your Fax Line for fully automatic Bi-Directional operation.

Or operate two Modems on one line.



EASY-CONNECT Pro
ALL 3 DEVICES IN ONE UNIT
Automatic Voice, Fax and Modem on One Line With Fax-Fax/Modem Link. EASY-CONNECT, FMX and SCAN MASTER all in one Product. It's called EASY-CONNECT Pro.



30 DAY MONEY BACK GUARANTEE

CHECK ALL OF THESE FEATURES:
✔ Multiple Extension Phones ✔ Answering Machine ✔ Cordless Telephone ✔ Any Device, Any Socket ✔ Any Fax and/or Modem ✔ Upgradeable Design ✔ Lightning Protection for Attached Devices ✔ Transparent Operation

NATIONAL COMMUNICATIONS
Australia's Telephone Line Sharing Company

Proudly Built In Australia Under US Licence

Austel Approved

☎ SYDNEY (02) 905 6670 ☎ MELBOURNE (03) 887 6200 ☎ ADELAIDE (08) 362 6776 ☎ PERTH (09) 470 2808 ☎ HEAD OFFICE (075) 965 128

READER INFO NO. 29

Modems & Data Communications:

ASKEY DYNALINK 1414VQE V.32bis MODEM

Established Taiwan modem manufacturer Askey Computer has recently opened an Australian office, and made quite an impact with its impressive range of Austel approved Dynalink high-speed models, carrying an unconditional three-year warranty. The 1414VQE is a very compact 14.4kb/s (V.32bis) data/fax desktop model, with a price significantly lower than almost all equivalent models.

by JIM ROWE

Rated as one of the 10 largest modem manufacturers in the world, Taiwan-based Askey Computer apparently produces around 75,000 V.32bis modems *per month*, at present. It has full ISO 9002 accredition, and its modems have been selling well in about 20 countries, including the USA and New Zealand — where they reputedly claim around 40% of the market.

Now the company has set up an Australian subsidiary, based in Sydney, and has launched a range of fully Austel-approved V.32bis (14.4kb/s) data/fax modems at prices well below most other name brands. There are four models in the Dynalink range, all carrying a three-year 'no questions' unconditional warranty: a desktop model, the 1414VQE; an internal ISA-bus card model, the 1414VQH; a 'mini' model, the 1414-VQM; and the 1414VQC, a PCMCIA card model for laptops and handhelds.

The desktop model 1414VQH is the largest in the range, but is still quite compact; its neat black plastic case measures only 147 x 123 x 30mm. As with many other modems this compact size has been achieved by using a separate 'plug pack' power supply, and in this case it's a quite bulky 13V/800mA unit.

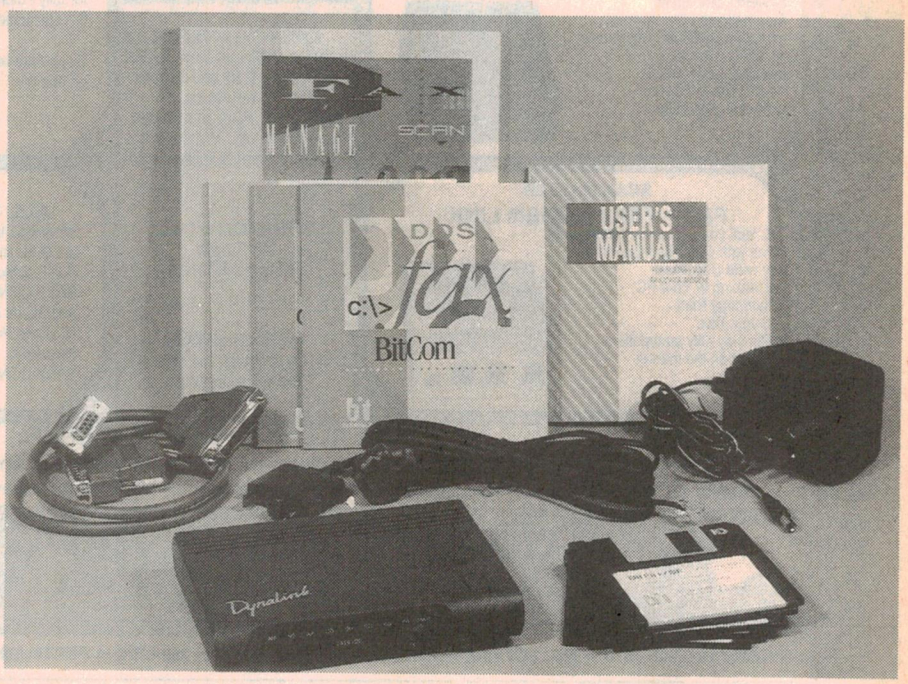
The modem has a row of nine status LEDs along the front, to give you a good idea of what's happening at all times. From the left, the LEDs indicate MR (modem ready/self test), HS (2400bps or higher speed in use), AA (auto-answer mode), CD (carrier detect), OH (off-hook), SD (send/transmit data), RD (receive data), TR (terminal ready) and PWR (power on). On the top is a slightly recessed power switch, while at the rear there's a small drop-down door which reveals the socket for the power cable, a standard DB-25 socket for the RS-232C serial cable from the computer, and a pair of RJ11 'modular' phone sockets — one for the telephone line input, and the other for an optional phone.

With the Dynalink 1414VQE comes virtually everything else needed for either data or fax communication on a PC. There's the matching plug pack supply, of course, and a cable to connect it to the PC; this has both DB-25 and DB-9 connectors at the 'other end', to make it compatible with virtually any standard serial port. There's also a cable for the phone socket connection, in this case a full 4.5m long to avoid the need for any extension cables.

You also get a set of matching software, for both DOS and Windows. For DOS users the *BitFax* and *BitCom* packages cover both faxing and data comms applications, while *Bitfax Professional for Windows* (V3.0) integrates the two functions for the Windows user. All three software packages come with informative manuals, while the modem itself also comes with a User's Manual and an External Installation Guide.

Like the other members of the Dynalink range, the 1414VQE is fully compatible with the Hayes 'Enhanced AT' command set, and implements fax Class 1 and Class 2 commands with a 40-character command buffer. It implements CCITT protocols V.32bis, V.32, V.22bis, V.23, V.22 and V.21 for data, and V.17, V.29, V.27ter and V.21 ch2 for fax. It also provides MNP4/V.42 error correction and MNP5/V.42bis data compression.

The bottom line is therefore that it's capable of operating at all standard data comm rates from 14.4kb/s down to



300b/s, plus 19.2kb/s, 38.4kb/s and 57.5kb/s in data mode when compression is being used. In fax mode it can operate in standard Group 3 mode, with speeds ranging from 14.4kb/s down to 2400b/s half duplex, and automatic fall-back.

All this comes for an RRP of only $400, which is well below the price of most models offering similar features.

Trying one out

Askey Australia very kindly made one of the Dynalink 1414VQE modems available, so we could try one out in practice. We tested it with a 33MHz '486 machine, but before doing so we fitted the latter with a Twincom high-speed serial port card, to ensure that computer would be capable of working at the high data rates involved. (See the separate review of the Twincom card.)

In passing, we didn't actually try out the Bitcom/BitFax software bundled with the Dynalink, as the computer already had *Telix for Windows* V1.0 installed. I'm told the bundled software is quite practical, but we were mainly interested in the modem itself and wanted to try it with known software — so that there weren't too many unknowns...

Basically, it hooked up without any hassles, and gave a very impressive performance. Initially we had a minor problem setting up *Telix* to suit it, because the program's extensive list of modems didn't list it specifically.

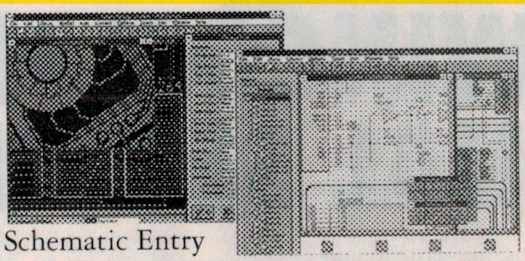
However a quick call to Askey solved *that* one — revealing that in the USA, the modem is known as the 'Zoom V.32'. When we found this in the *Telix* list, and then modified the modem initialisation string to suit Australian and local requirements (pulse dialling, no guard tone, at least two rings before auto-answer, etc.), it was all plain sailing.

(A list of Austel setup requirements is provided in the front of the User Manual, by the way, and there's also a helpful sheet giving a suggested 'init string' for Australian users.)

We used the 1414VQE to make a number of contacts with BBS systems, and also with a local Internet access provider. It performed faultlessly, and gave every indication of being a completely 'transparent' communications interface. So if you're in the market for a 14.4kb/s data/fax modem, the Askey Dynalink 1414VQE is well worth considering.

Askey Australia can be contacted via PO Box 103, Willoughby North 2068; or phone 1800 653 962, for information on your nearest dealer. ❖

Protel Design System for Windows



- Schematic Entry
- PCB Design
- Autorouting
- Autoplace
- Simulation
- FPGA and PLD support

Low cost Upgrade for DOS users

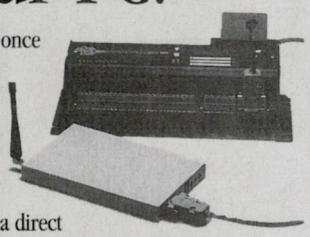
For more information phone
Toll Free 1800 030 949

Protel Technology
GPO Box 204
Hobart Tas 7001
Phone:1 800 030 949

Protel for DOS still available $995

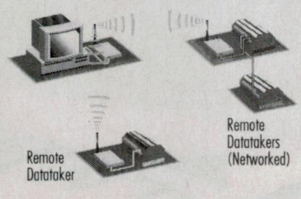
READER INFO NO. 30

Wireless data logging for your PC.



Now you can be in many places at once collecting data and sending it directly to your computer.

A Datataker radio modem system gives you freedom to place your data loggers up to 10 kilometres from your PC. You have the convenience of a direct serial link for downloading collected data, changing programming, and monitoring in real time. Datataker uses sophisticated RF spread-spectrum technology for error-free wireless transmission even in areas of high electrical interference. Ideal for use in factories as well as outdoor applications.



Datataker data loggers give you the choice of up to 150 analog inputs, 84 digital inputs, and 44 digital outputs on a single logger. Cable or radio networking. Direct connection of all common sensors, no extra modules needed. Compatible with all computers, from notebooks to mainframes. PC software included. Data logging has never been this easy.

Let us show you how Datataker can make your data acquisition hassle-free. Call the data acquisition experts...

Data Electronics
7 Seismic Court Rowville VIC 3178
Tel (03) 764 8600 Fax (03) 764 8997

AD-006-B0

READER INFO NO. 31

Modems & Data Communications:

TWINCOM HIGH SPEED DUAL SERIAL CARD

Manufactured in Australia by Custom Built Computers, the Twincom high speed dual serial card provides two fully configurable ports using 16550A buffered UARTs. Both ports can support speeds of up to 115.2kb/s, making the card very suitable for use with fast modems and terminal emulation programs.

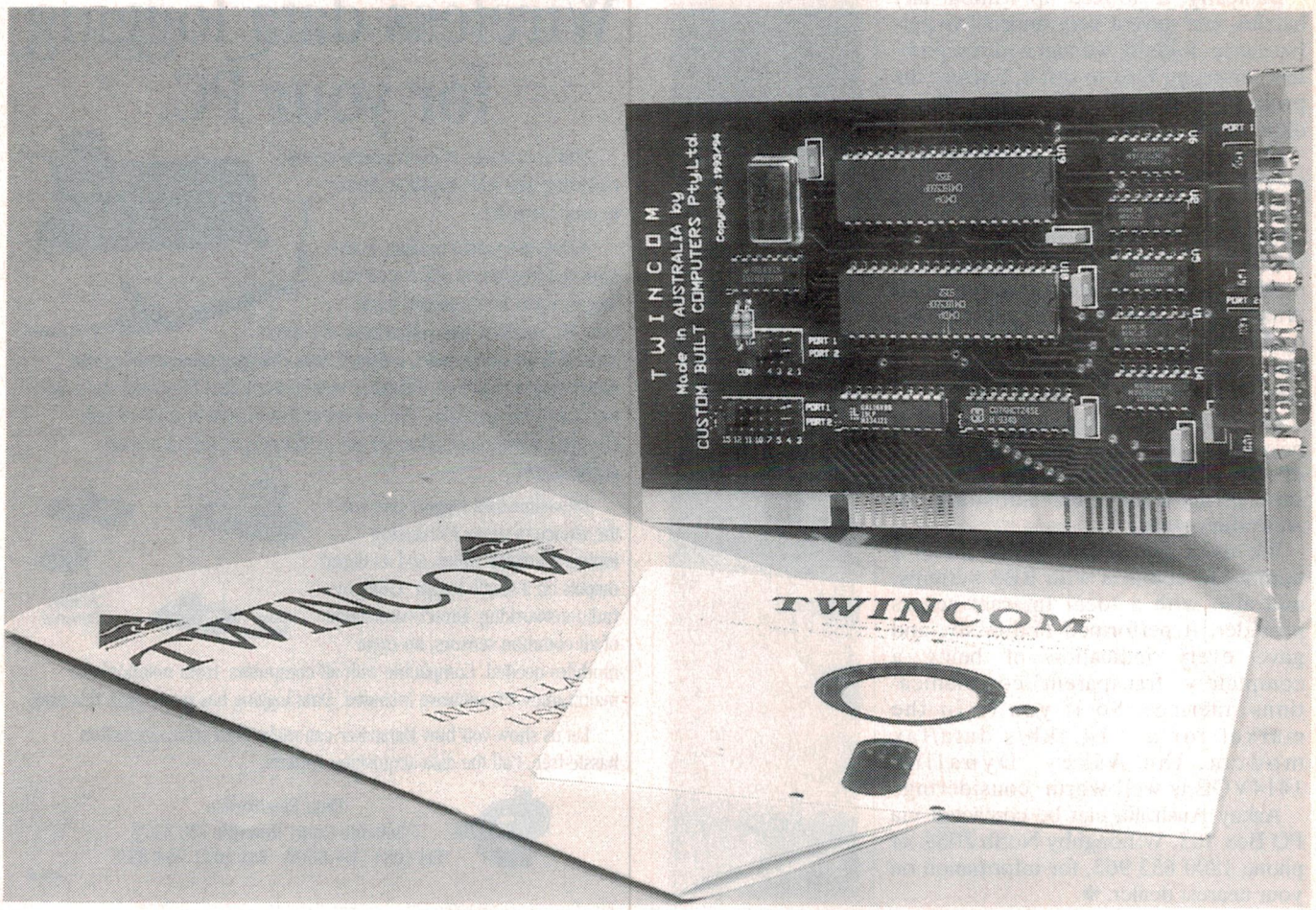
by JIM ROWE

As part of the almost explosive growth in data communications, more and more of us are needing to provide our PC's with a modem. And increasingly that modem has to be capable of *fast* data transfer — not just because on-line time tends to equate with money, but also because more and more of the information we need to transfer consists of images and other graphical data.

Almost gone are the days of relatively compact text files, which could be transferred at a leisurely 1200b/s or even 300b/s!

Thanks to recent developments in modem technology, the 'standard' data communication rate has jumped to 14.4kb/s, with many of the advanced users employing modems capable of 28.8kb/s — even though the standards for that rate aren't fully settled. Modems offering 14.4kb/s V.32bis fax/data comms with MNP4/V.42 error correction and MNP5/V.42bis compression are now available for less than $400 complete with matching software, bringing them within reach of a very wide group of users...

The only trouble is that the RS-232C serial ports fitted to many personal computers are really not capable of allowing this new breed of modem to achieve its full potential. Often they use either an 8250 or 16450 UART chip, and neither of these is really capable of



'keeping up' with modems working at rates faster than about 9600b/s. With a 14.4kb/s modem using data compression, for example, the modem-computer link frequently needs to transfer 'bursts' of up to 57.6kb/s. As well as requiring a faster UART, this really calls for one with an inbuilt data buffer, so that data isn't lost as the result of an inability of the computer's software to service the UART fast enough.

The solution to these problems is to use a modern high speed *buffered* UART chip such as the 16550A, and this is generally what's used in the latest machines. Although this chip with its internal 16-byte buffer can also be used to replace the older UART in some existing serial ports, this often isn't a straightforward or trouble-free operation. For many users, a far more attractive approach is simply to fit a new serial port card using one or more 16550A chips, either instead of, or as well as the original card — perhaps leaving it to handle things like your mouse, etc.

The Twincom card is designed for this very purpose, and the first pleasant surprise is that it's designed, manufactured and *supported* right here in Australia by Custom Built Computers, of Carlton in NSW. This already makes it pretty unique among PC cards, because the vast majority are imported from distant shores...

A standard ISA-bus card, the Twincom is suitable for use in any 286, 386 or 486 type machine. It provides two high speed serial ports, each using a 16550A buffered UART and able to operate at up to 115.2kb/s. And a particularly nice feature is that both ports are highly configurable in terms of both their I/O address and interrupt request line. They can be set as any two addresses in the range COM1 - COM4, and to use any of IRQ lines 3, 4, 5, 7, 10, 11, 12 or 15. That's what I call *flexibility* — and when you're fitting extra cards into a modern PC, it comes in very handy indeed.

What makes the Twincom especially 'friendly' is that the I/O address and IRQ line configuring is done very simply and unambiguously, using jumper shunts on two clearly-marked header strips. And these are arranged so that it's impossible to achieve a clash between the two ports on the card itself, so all you have to worry about is clashes with other parts of the system.

Even here CBC has gone out of its way to help you avoid trouble, because with the Twincom comes a disk with some diagnostic and other utilities, designed to simplying the configuring process.

Contrary to popular belief, many of the popular 'system information' and 'diagnostic' programs *don't* properly check the true address and IRQ line used by comms and printer ports — they often just read the DOS configuration data stored in lower memory, and DOS itself seems to have problems identifying these things. But the *TWINCOM.EXE* utility supplied with this card *really* checks things for itself, and comes up with accurate information on I/O address and IRQ usage. So by running this first, and then setting up your Twincom card to avoid clashes, configuring and installing the card is made easy and hassle-free.

Other software provided on the disk are a pair of small drivers to make DOS aware of the new ports, when you've set them up for higher IRQ's, and a set of Advanced Serial Port Utilities supplied under licence from US firm Computer Telecommunication Systems, Inc.

Trying it out

Custom Built Computers very kindly sent us a Twincom board, to try it out for ourselves. When we opened the box we found it to be very nicely made, with clear silk-screened legends and high-grade gold edge connectors. The two serial connectors are of the standard DB-9 male variety.

Installing and configuring the card in a 486/33MHz machine turned out to be a breeze, despite the fact that the machine already had a host of 'extras' already installed. First we ran *TWINCOM.EXE*, which told us that COM3 and COM4 were free, and that IRQ's 10 and 12 were similarly unoccupied. So it was simply a matter of setting the card's jumper shunts to use these settings, and installing it.

When the computer was fired up again, we ran *TWINCOM.EXE* a second time to confirm that all was well. It reported that we now had a total of four COM ports, that the COM3 and COM4 ports were fitted with 16550A chips, and that we had no address or IRQ clashes...

Following the instructions in the Twincom manual, we also had no trouble installing the little *TWIN34* driver to make sure DOS was aware of the new ports. Similarly it was easy to update *Windows*, following which we were able to put the Twincom ports to full use.

As mentioned elsewhere in this issue, we tried the Twincom card out with one of the new Askey Dynalink 1414VQE 14.4kb/s fax modems. Using the new *Telix for Windows*, V.1.0, we were able to make many successful hookups to both BBS systems and an Internet access provider, and transfer quite a few sizeable files without a murmur of trouble.

In fact with *Telix* having programmed the Twincom port for the recommended 57.6kb/s, we were frequently able to hit average data rates of over 3500 characters/second when transferring plain text files — most impressive. This is of course mainly attributable to the modem's MNP 5 data compression and its effectiveness with uncompressed text files; but without the Twincom's ability to handle 57.6kb/s, the full benefits of MNP 5 at 14.4kb/s couldn't be achieved. (The same would apply for a 28.8kb/s V.fast modem, I'm sure.)

So if you're upgrading to a 14.4kb/s modem, our impression is that the Twincom would make an excellent choice as the matching high-speed serial port card. Especially as it's locally supported by the manufacturer, and costs only $140 including tax.

Further information is available from Custom Built Computers at Suite 1, 1 Short Street, Carlton 2218; phone (02) 587 7111, or fax (02) 587 9973. ❖

FAXMODEMS
MODEMS

As acknowledged specialists in P.C. Communications, we can provide a solution for your Business, Home or Educational needs.

Prices start from $199.00!

- ✔ Fax directly from your apps.
- ✔ Receive faxes in background.
- ✔ Austel approved.
- ✔ Best overall value for money.
- ✔ Simple to set-up. Easy to use.
- ✔ Unlimited support.

Dealer Inquiries Welcome



HH
COMPUTER HAND HOLDING
Ph: (07) 8578811 Fax: (07) 857 8811

READER INFO NO. 32

Silicon Valley NEWSLETTER



AMD-Fujitsu open Flash memory plant

Advanced Micro Devices and Fujitsu have opened what is claimed as the world's largest facility for the production of Flash memory chips, located in Aizu-Wakamatsu, Japan.

The two companies have invested some US$750 million in the facility, which measures 200,000 square feet overall with 70,200 square feet of cleanroom space. The plant will produce more than 5000 eight inch wafers a week when at full capacity.

The joint venture, Fujitsu-AMD Semiconductor Ltd, was established in 1993. The venture was formed to allow the two companies to aggressively compete in the Flash memory market, which has been the fastest growing segment of the semiconductor industry, AMD said.

First production products are 16-megabit Flash memories. Volume production will commence by the year end with shipments beginning in the first quarter of 1995.

"Fujitsu and AMD both share the belief that innovative technologies and ideas provide the foundation for competitive advantage," said Jerry Sanders III, AMD's chairman and chief executive officer.

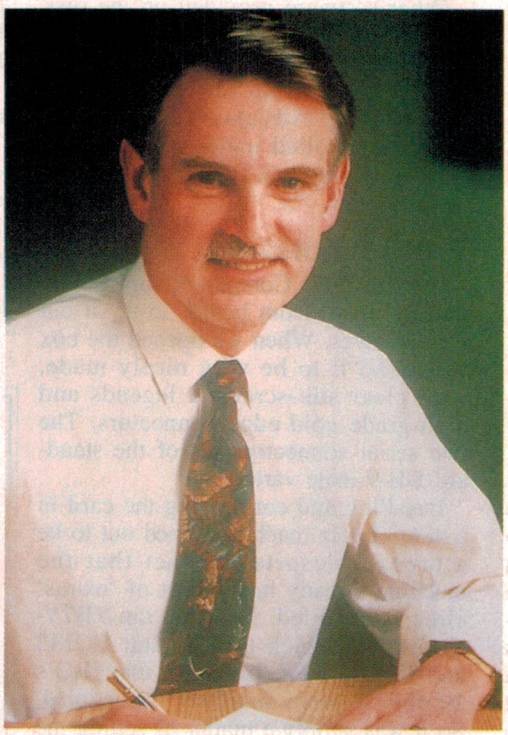
"Strategic alliances are one of the main pillars of our company's management philosophy," added Tadashi Sekizawa, president of Fujitsu. "Today, no single company can bear the ever-increasing cost of research, development and manu- facturing in the information technology industry."

Total world wide sales of Flash memories will top US$1.1 billion in 1994 according to market researchers In-Stat in Scottsdale, Arizona.

Apple announces Mac licensing program

Apple Computer is allowing a number of selected companies around the world to produce clones of the Macintosh, marking the first time in Apple's history the company has allowed anyone to make copies of its machines.

But unlike earlier expectations, Apple intends to closely regulate the Mac clone market. All of the companies involved in the licensing program are based in non-English speaking markets, and they are only allowed to licence the non-English versions of the Macintosh operating system — effectively keeping clones out of the US, UK, Australia and other English-speaking markets.



Dave L. House, senior vice president and director of corporate strategy for Intel in Santa Clara, who visited Sydney earlier this year and gave briefings on near-future developments in the company's microprocessor chips.

The initial licensing agreements are with Olivetti of Italy, Fujitsu in Japan, and one German firm. The licensing program is part of Apple's effort to increase the market share of the Macintosh beyond the 10-12% it has been at for most of the past decade. Additional market share is critical to ensure software developers will continue to make every effort to develop applications for the Macintosh family in a timely fashion.

Stanford breakthrough in 3D memory

Imagine a crystal cube, no bigger than two lumps of sugar. The crystal sits at the heart of a computer system, not far from the microprocessor. It stores 1000 times more information than a typical high end disk drive and retrieves the data 100 times faster as well. Such an idealistic data storage device may only be a few years away, as Stanford University researchers have developed working prototypes of a holographic data storage device.

The device was developed by a team headed by Professor Lambortus Hesselink and several of his graduate students. Hesselink has devoted much of the past 12 years to the development of the holographic based data storage device.

The Stanford system uses lasers to encode two dimensional 'pages' inside the cube with large volumes of data, using individual crystal atoms to store the data. By varying the angles of the laser recording heads, many such two dimensional pages can be stacked in the three dimensional cube.

"The hope is that we won't have to wait until the year 2000 for this technology to reach the market. If it works out, it will be difficult for conventional storage systems to compete with this technology," said Hesselink.

The Hesselink system uses the laser beams to focus on a particular position-within the cube, much like the cross-shairs on a rifle scope zero on a small target. The laser is capable of changing the electrical characteristics of individual crystal atoms within the cube. This way data can be stored in much the same 0/1 (on/off) system used in other recording systems.

The Stanford system was developed with several million dollars in grants

from the Pentagon's ARPA group (Advanced ResEarch Projects Agency).

Hesselink said a single 3D storage cube will be able to store enough information to play back a one hour full motion movie. The error rate so far has been one in six million bits of data, which Hesselink said is within acceptable limits. Future enhancements will further reduce the error rate.

Other problems which Hesselink said still need to be worked on is reducing the number of imperfections in the crystals, and the recording speed. The Hesselink prototype is still very slow, at about 160 kilobytes of data per hour.

Pocket answering machine, pager

Imagine an answering machine that you could wear on your belt. That is one of two new pagers for which Motorola announced development plans.

The answering machines, to be known as the 'VoiceNow' will be developed jointly with Paging Network, one of the largest paging service companies in the United States. The deal could mean US$250 million in new revenues for Motorola over a five year period. The product would be manufactured at Motorola's plant in Boynton Beach, Florida, and is expected to be ready for testing at the end of 1995.

"It's an answering machine like the answering machine in your home, but it's small, portable and wireless," said Julie Sullivan, spokeswoman for Paging Network, or PageNet, of Plano, Texas. Also to be manufactured at Boynton Beach is a new pager called Pro Encore, that will be the first to have its signals sent over the new Flex high speed transmission system.

The network is expected to make possible two way pagers, which are expected to be available for sale in mid 1995. The pagers would allow the receiver of a message to send a message back, such as 'yes', 'no', or 'call me later', said Motorola product planning manager Sheila King.

The VoiceNow product will be slightly smaller than a deck of cards, Sullivan said. It is expected to deliver a voice message, rather than a typed message, like today's alphanumeric pagers. The voice message would save many callbacks, since it's easier to deliver an entire message, she said. PageNet said it expects to lease the pagers for about US$20 a month.

The Pro Encore pager is a numeric pager, but it works longer, about 160 days, on a set of batteries, according to Motorola. It allows up to sixteen 20-digit messages, up from a current eight. The Flex transmission system also means better protection against fading signals.

80-megabyte Flash drive

Flash card memory drive maker SunDisk has introduced the SDIA-80, the world's first 80MB 1.8" flash storage device. Effective storage capacity can be doubled to 160MB with a pre-loaded Stacker compression option.

The new SunDisk IDE FlashDrive is an embedded, ruggedised storage product targeted at makers of computers used in industrial markets such as manufacturing, shipping, aviation, trucking, steel mills, foundries, mining, electronics, logging, and military agencies.

Leon Malmed, SunDisk vice president for world wide sales and marketing of SunDisk, which holds a 60% share of the market for flash mass storage cards, said: "We've developed the SDIA-80 because our many customers who work with embedded applications in harsh, severe work environments have been asking for more and more storage capacity.

With its industry-standard IDE interface, low power requirements and reliable performance, we expect that the SDIA-80 will meet with wide acceptance in the market place."

Volume shipments of the SDIA-80 started in August. High volume, OEM pricing for the SDIA-80 is under US$2000.

The FlashDrive uses less than 5% of the power required to operate rotating, magnetic 1.8" and 2.5" hard disk drives. And the SunDisk FlashDrive, which has an operating shock rating of 1000 G's (equivalent to a drop of eight feet), is able to withstand at least five times more shock and vibration than rotating 1.8" drives.

New Alpha chip breaks BIPS barrier

Struggling Digital Equipment has taken the microprocessor industry a giant leap forward with the launch of a new Alpha RISC processor, capable of executing 1.2 billion instructions per second.

The chip contains nine million transistors, three times the number Intel has crammed onto its state of the art Pentium chip. At 300MHz, the Alpha processor is also three times faster than the Intel chip.

DEC said the compatibility to the NT operating system makes the chip, which the company has incorporated into a new line of AXP workstations and servers, ideal for networking and client service applications. DEC chief executive officer Robert Palmer said the chip sets a pace that no others have been able to match. Digital said it has sold more than US$1 billion in earlier versions of the Alpha AXP since its introduction in November 1992.

Court rebuffs Kilby patent

Texas Instruments, which has reaped hundreds of millions of dollars a year from its Japanese competitors in IC patent royalties, has suffered a legal setback when the Tokyo District Court ruled that Fujitsu had not infringed on Texas Instruments' so-called Kilby Semiconductor Patent, in the production of three of its many chip products.

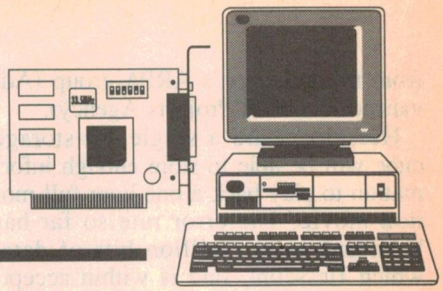
The news sparked a sell off in the shares of Texas Instruments on the New York Stock Exchange, where TI shares fell $5.25 to US$77.25. Industry analysts, however, said the Kilby patent is only one of thousands that cover a broad class of TI's microchip technology. The court decision is expected to have a limited effect on the company's overall royalty income.

The Kilby patent was awarded to TI only four years ago by Japan's patent office, after being held up in bureaucratic delays for more than 30 years after TI first filed for the patent. It is named after company engineer Jack Kilby, the co-inventor of the integrated circuit. The patent essentially applies to all integrated circuits made, used or sold in Japan today.

The Japanese court ruled that the Japanese patent, which expires in 2001, covered old technology and did not pertain to the products being manufactured by Fujitsu. TI officials protested the ruling, saying today's integrated circuits operate on the same basic principle as those described in the Kilby Patent. The Kilby patent was included in the broad cross licensing agreements TI negotiated with most Japanese semiconductor manufacturers in 1990. However the patent was excluded from TI's agreement with Fujitsu.

Fujitsu filed suit against TI in 1991, asking the court to declare that the Kilby patent did not pertain to two of its products: the one megabit DRAM and the 32KB PROM. Fujitsu's four megabit DRAM chip was also included in the court's decision. ❖

Computer News and New Products



PCMCIA data acquisition card

The DACpad-71 is a type II PCMCIA data acquisition card for laptop computers and other computers with a PCMCIA slot.

The DACpad-71A has a 12-bit ADC and a programmable gain of one, two, four or eight. It accepts eight channels of differential input at a sampling rate of up to 30kHz. It also has a four-bit digital input port and a four-bit digital output port (both TTL compatible).

The DACpad-71B is a high gain, low input version of the DACpad- 71A, which allows direct sensor input. Both types use very little power so they can operate in battery-powered PCs. The cards include a plastic-enclosed signal conditioning daughter board.

Applications include data logging in the field, portable measurement systems, transducer/sensor interfacing and contact closure monitoring. The cards meet PCMCIA release 2.01 standards, and feature low power consumption, eight differential input channels and a +/-10V or 0 to 10V input range.

C and BASIC drivers are included and a Windows DLL driver is optional. The DACpad-71 is also supported by a range of software packages, including L/T Notebook, L/T Control, Genie, DAXpert and DASYLab.

For further information, circle 161 on the reader service coupon or contact Priority Electronics, Suite 4 and 5, 23-25 Melrose Street, Sandringham 3191; phone (03) 521 0356.

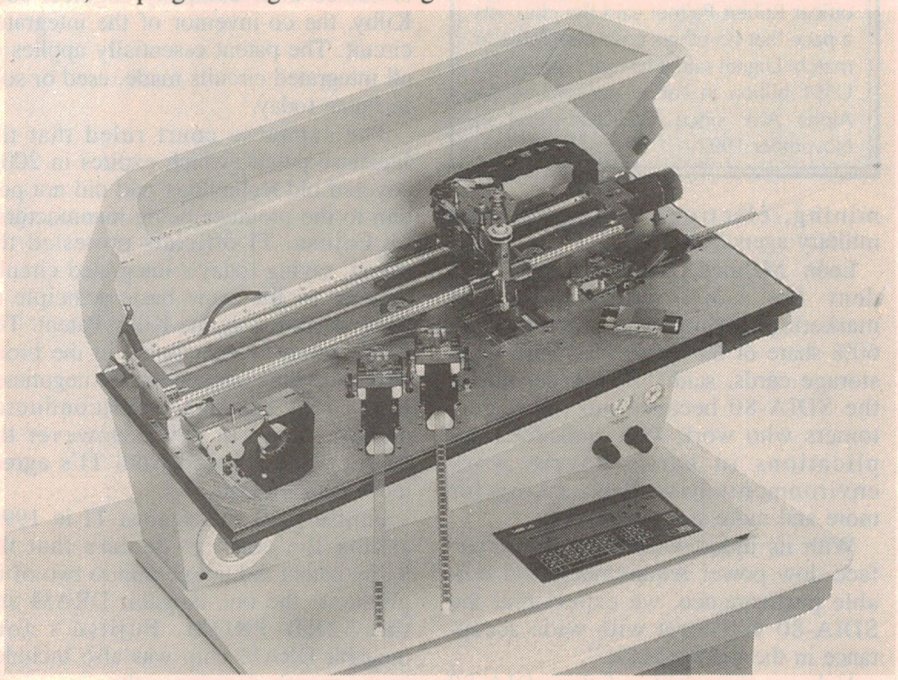
Production programmer

Data I/O's ProMaster 2500 is a fully integrated automated system for handling, programming, testing, sorting and labelling programmable devices. Providing universal support for DIP, PLCC and SOIC packages the ProMaster 2500 will program, label and sort as many as 550 devices per hour.

The pick-and-place head rotates devices, so programming and labelling can occur regardless of device orientation in the tube.

A high-speed printer prints and applies device labels in one operation. Tube holders, one at the input and two at the output, accept any standard programmable IC tube.

For further information, circle 168 on the reader service coupon or contact Nilsen Technologies, 150 Oxford Street, Collingwood 3066; phone (03) 419 9999.



5MHz function generator card

Applications of the new AX5830 function generator card from Boston Technology include automatic test equipment (ATE), general purpose bench instrumentation, product test and laboratory automation.

The card requires a single expansion slot inside an IBM PC/XT/AT or compatible computer. It can produce sine, square, or triangle waveforms and has all the features and accuracy of a standard bench-top function generator.

The card operates in two modes: as a standard bench instrument with a pop-up display, or as a programmable device using language independent commands. The AX5830 software operates in a 'pop-up' fashion under both MS-DOS and Microsoft Windows. The software displays all the operating information in a layout like a bench-top instrument and all operating parameters can be adjusted from the display.

For system applications, the card can be programmed by language independent commands. For example, to generate a 5Vp-p 1MHz sinewave, the command is: Set Form Sine,Freq 1M,Amp 5. Because the card is designed for use in harsh ATE environments, its main output is fully isolated from the computer. Connections to the card can be made with either banana plugs, or a standard BNC connector.

For further information, circle 166 on the reader service coupon or contact Boston Technology, PO Box 1750, North Sydney, 2059; phone (02) 955 4765.

Workstation for field technicians

Designed to fit in a toolkit or hang off a belt, the T5000 computer is a compact, rugged handheld workstation for field technicians. It is fully weather resistant and built to withstand multiple 1.2-metre drops onto concrete, whether the lid is open or closed.

The computer operates with a stand-

SCSI switch

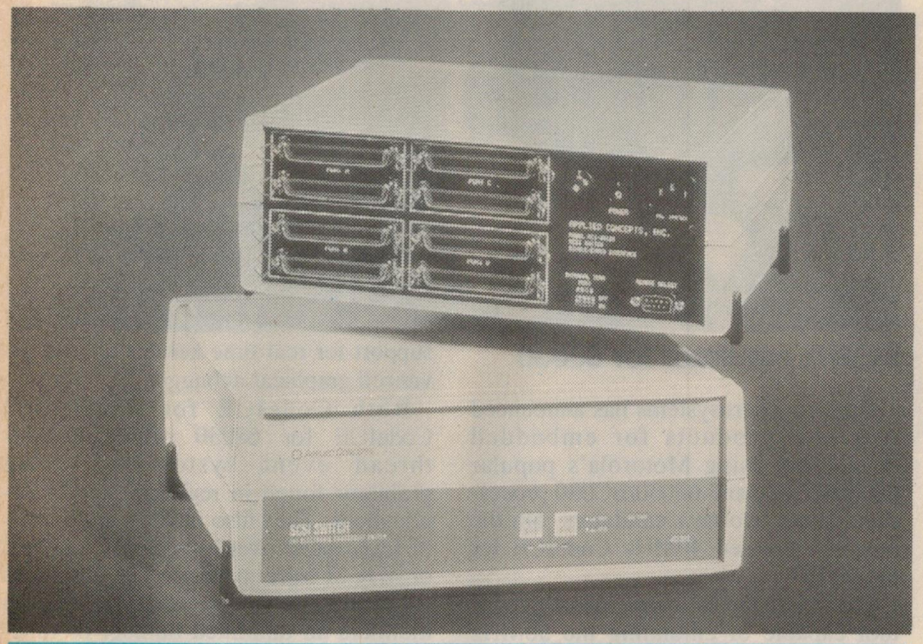
The SCSI switch, model ACI-2014 from Graphics Computer Systems offers both local and remote switching of multiple SCSI computer and peripheral buses. The switch is supplied with Windows, Macintosh and Unix software to control selection via a standard RS-232 computer port. This means peripherals can be shared between different computers without reconfiguring cables or bus terminators.

It supports standard eight-bit and 16-bit (wide) SCSI devices and enables disks, imaging cameras, page scanners, RAID arrays, tape backup systems and CD-ROMs on six independent SCSI buses to be connected and exchanged electronically.

Daisy-chained connectors on the rear panel interface to each SCSI device or chain. Port selection is provided by the front panel or remote RS-232 interface. Up to four SCSI switches can be controlled from one RS-232 interface, and the front panel indicators identify selected SCSI ports and bus activity.

Model ACI-2014 ASN supports 50-pin Centronics cables and has an RRP of $3700, Model ACI 2014CSN uses 50-pin high density SCSI-2 connectors and also sells for $3700. Model ACI-2014CSW supports 68-pin wide SCSI-2 and SCSI-3 devices and retails for $5330.

For further information, circle 167 on the reader service coupon or contact Graphics Computer Systems, 22 Harker Street, Burwood 3125; phone (03) 888 8522.



ard MS-DOS operating system, and a PCMCIA memory card slot allows users to expand memory, or quickly change applications in the field. An integrated loop tester provides technicians with a complete suite of diagnostic testing tools, including fully programmable test sequencing, customisable user interface and test results capture. Communication options include an integrated wireless modem and an internal modem. Users can connect with wide-area RF networks such as ARDIS and RAM Mobile Data for real-time communication, or use telephone line data communication.

The unit measures 249 x 127mm, and is easily held in one hand while being operated by the other. The lid can be opened with one hand and the shift key works sequentially to allow one-handed shift functions. The display is a scratch resistant high-contrast reflective LCD and the computer has 1MB of RAM, expandable to 3MB.

For further information, circle 163 on the reader service coupon or contact Telxon, PO Box 238, Epping 2121; phone (02) 876 7222.

LA-VIEW Software

Tektronix has announced LA-VIEW software, which gives engineers designing real-time embedded systems a way to review and analyse information on a Sun workstation, independent of the instrumentation. This allows a larger number of engineers to use a single networked logic analysis system for prototype troubleshooting and software debugging.

For example, using LA-VIEW, embedded system designers can automatically upload data acquired by a logic analyser, then link that data in

From Imp & EA
Impulse Measurement Processor
OLD COLONY SOUND LAB

complete kit of parts	$229.00
Imp software	$100.00*

key parts kit - all ICs, & hard to find parts. No case, wire, resistors, capacitors, solder connectors etc $159.00

Imp parts

Mic capsule 6mm	$9.95
A-D MAX190 IC	$29.00
PCB board only *DSTHP*	$25.00

call for detailed listings and current prices

Demo disk $5 - refundable

*prices +21% sales tax except software, subject to change without notice

ME Technologies
(an ME Sound Pty Ltd subsidiary)
P.O.box50, Dyers Crossing NSW 2429
☎ 065 50 2200, 065 50 2341

READER INFO NO. 33

YOSHI
ELECTRONICS AND RESEARCH

We can supply Japanese electronic kits for general purpose use and also supply information on all technical matters.
Please call us or mail order for futher information, we will reply by mail or fax.

YOSHI
ELECTRONICS & RESEARCH
60 Sandilands Street,
Bonalbo NSW 2469
Ph/Fax (066) 65 1349
or phone/Fax Japan
0011 81 423 680 161

READER INFO NO. 34

one window with source code in another window.

The multi-window environment allows multiple views of the same data and simultaneous time correlated views of data from multiple processors. The search capability provides rapid access to data values.

For further information, circle 169 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066.

Low cost video camera for Macintosh

QuickCam is a low-cost video camera that connects to the serial port of a Macintosh computer. It provides four-bit greyscale video in image sizes up to 240x320 at up to 15 frames per second.

With QuickCam, Macintosh users can record QuickTime movies, capture still pictures in PICT format, and record sound from the built-in microphone. The camera provides digital input directly into the Macintosh through the serial port. Because it draws its power from the Macintosh serial port, there is only one cable to hook up.

The camera is supplied with several software packages, including a full-featured video recorder application that allows users to record and edit QuickTime movies created by the camera. The software also allows the user to capture time-lapse movies by specifying capture of a movie in terms of frames per second or minute.

Also included is a desk accessory that allows users to grab still photos in PICT format at any time. The captured still is saved in a PICT file of the user's choice, or may be copied to the clipboard for instant use.

QuickCam is designed around a high-quality black and white CCD (charged couple device), similar to that used in video camcorders. QuickCam differs from other devices using CCDs, in that the pixels derived from the CCD array are not converted into analog video. Instead, the camera sends the pixels as digital bits to the Macintosh.

For further information, circle 162 on the reader service coupon or contact Firmware Design, 28 Coombes Drive, Penrith 2750; phone (047) 21 7211.



50MHz emulator for 68030

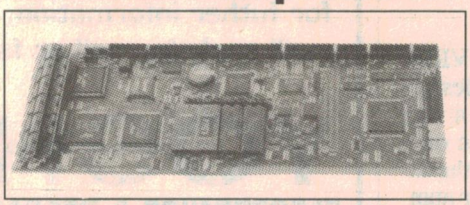
Applied Microsystems has announced two new products for embedded developers using Motorola's popular 68020/EC020 and 68030/EC030 processors. These two new emulators join the recently released 40MHz CodeICE for the 68040.

The emulator is a processor-specific tool capable of emulating the 50MHz 68030 and the 40MHz 68EC030. As well, the CodeICE can be quickly reconfigured to support any family members from EC020 to 68040. All CodeICE emulators include integrated support for real-time kernels and an advanced graphical debugger.

Both CodeICE for 68020 and CodeICE for 68030 offer a multi-thread event system to debug problems found in real-time kernel applications. They also include up to 4MB of high-speed overlay memory, and 8K or 32K of trace memory. The auto-configured performance analysis system monitors an unlimited number of functions or data objects.

For further information, circle 164 on the reader service coupon or contact Metromatics, PO Box 315, New Farm, 4005; phone (07) 358 5155. ❖

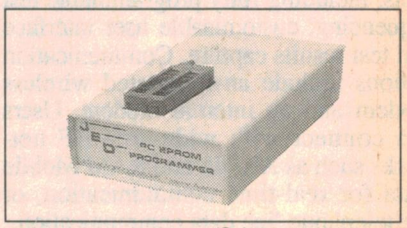
Australian Computers & Peripherals from JED... Call for data sheets.



The JED AT303/304/305 is a family of 16 to 40 Mhz computers uses 386SX, 486SLC or 486SLXC2 CPUs. It has on-board RAM, PROM or FLASH disks, as well as floppy, IDE and JBUS digital I/O. On board are COM1/2, LPT, KBD. and Mouse ports and optionally COM3 with RS485. Priced from $880 with 1m DRAM. A1 Mbyte FLASH disk is $150.

$125 PROM Eraser,complete with timer

$300 PC PROM Programmer.



(Sales tax exempt prices)

Need to programme PROMs from your PC?

This little box simply plugs into your PC or Laptop's parallel printer port and reads, writes and edits PROMs from 64Kb to 8Mb.
It does it quickly without needing any plug in cards.

JED Microprocessors Pty. Ltd

Office 7, 5/7 Chandler Road, Boronia, Vic., 3155. Phone: (03) 762 3588 Fax: (03) 762 5499

FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...WOOD FOR CHIPS...

The Complete Semiconductor Listing – Part 3!

In response to your many requests we are giving a comprehensive listing of the semi's we stock, we suggest you cut this ad out or photocopy for future reference!
Part 1 & 2 were in October & November

OPTOCOUPLERS

4N25	Coupler Trnstr Out	$1.45
4N26	See 4N25	$1.45
4N28	See 4N25	$1.45
4N32	Coupler D/Ton Out	$1.25
4N33	Coupler D/Ton Out	$1.45
4N35	Coupler Tstor Out	$1.20
4N38A	Coupler Tstor Out	$1.50
6N138	Coupler, Lo Sat Hi G	$5.55
6N135	Optocoupler	$5.30
6N139	Coupler, Lo Sat Hi G	$7.90
CNY17-4		$2.15
CNY70		$3.45
MOC3021	Coupler Triac Drvr	$2.65
MOC3041	Coupler ZXing Drvr	$2.15

PROCESSORS

6502AP	8 Bit Processor	$10.15
65C02	8 Bit Processor	$16.70
6505	8 Bit Processor	$22.50
6512	8 Bit Processor	$8.95
6520A	8 BIT P.I.A.	$14.00
6521	8 BIT P.I.A.	$11.05
6522	8 BIT P.I.A.	$13.15
65C22P	8 BIT P.I.A.	$17.15
6532AP	(R6532AP)	$17.80
6551-27	A.C.I.A.	$9.30
6800P	8 Bit CPU	$17.60
6802P	8 Bit CPU + RAM	$8.50
6803P		$11.90
6809P	8/16 Bit CPU	$10.15
MC68B09EP	MPU	$16.65
6821P	P.I.A.	$5.85
68B21P	P.I.A.	$9.00
MC68B44P	MPU	$15.90
6852P	S.S.D.A.	$12.05
6840P	Prog Timer	$7.70
68B40P	Prog Timer	$15.20
68B44P	DMA Controller	$97.25
6845P	CRT Controller	$8.35
68B45P	CRT Controller	$19.45
6847P	Video Disp Gnrtr	$37.10
6850P	A.I.A.	$9.00
68B50P	A.I.A.	$10.15
6875P	2 Phase Clk Genrtr	$22.45
8253P-5	Timer/Counter	$22.60
82C53ARS-5-9	CMOS 8253	$20.35
82C55A-2-P	Pgmbl Per. Ifce	$10.25
8259A	Interrupt Cont	$16.60
146805EP	8 Bit CMOS CPU	$22.75
68000-CP16	16 Bit CPU	$40.40
68705P3S	CPU,3.7K EPROM	$35.70
D82C501	Ether Serial Infce	$64.25
MC146805E2P	CMOS 6805	$12.05
V30	Improved V20	$30.05
Z80A-CMOS/CPU		$10.45
Z80B-CPU		$5.50
Z80B-CTC	8 Bit CTC	$5.20
Z80B-DART	8 Bit Dual UART	$13.05
Z80B-PIO	8 Bit PIO	$8.65
1793-02	Floppy Disc Cntrlr	$34.35
DP8216N	4 Bit Bidi Bus Tcvr	$4.50
DP8226N	4 Bit Bidi Bus Tcvr	$4.30
DP8303N	8 Bit Bidi Bus Tcvr	$4.25
DP8304BN	8 Bit Bidi Bus Tcvr	$3.80
DP8310N	Octal Latched Driver	$8.65
DP8311N	Octal Latched Driver	$9.90
DP8340N	Data Comm Tx	$66.80
DP8341N	Data Comm Rx	$66.75
DP8419N-70	DRAM Con/Dr	$126.20
IM4702IPE	Pgmbl B R Gnrtr	$17.20
INS8250AN	Asynch Comm	$17.00
INS8900D		$101.00
NS16450N	UART IBM PC/AT	$12.70
PC16550DN	UART	$33.45
TCM3105LN		$14.60
TMS2793NL	Floppy Driver	$55.05

ANALOGUE SWITCHES

AM3705CN	8/1 An Mux	$11.50
LF13201N	Quad SPST Sw NC	$9.20
LF13202N	Quad SPST Sw NO	$6.70
LF13331N	Quad SPST Switch	$6.50
LF13508N	8 Channel Mux	$14.85
LF13509N	4 Channel Mux	$12.65

SPECIAL FUNCTION

14411	Bit Rate Fqcy Gnrtr	$28.70
14490P	Hex Sw. Debounce	$7.85
145026P	Rem Control Encdr	$3.70
145027P	9 Bit Trinary Dcdr	$3.70
145028P	Rem Control Dcdr	$4.80
ICL8038CCJD	Func Generator	$12.40
ICM7209IPA	10MHz Clock G.	$15.30
ICM7213IPD	Precision Clock	$21.35
ICM7240IJE	CMOS Timer	$6.90
ICM7555IPA	See LMC555CN	$1.95
ICM7556IPD	Dual CMOS Timer	$5.80
LH0094CD	Analog Math Bl	$228.70
LM322N	Precision Timer	$1.75
LM331N	Voltage/Freq. Co	$7.95
LM555CN	Timer	$0.75
LM556CN	Dual Timer	$2.80
LM1812N	Ultrasonic Det.	$14.20
LM2907N	Freq/Voltage Comp	$2.60
LM2907N-8	Freq/Voltage Co	$4.75
LM2917N	Freq/Voltage Co	$3.15
LM2917N-8	Freq/Voltage Co	$3.20
LM3905N	Precision Timer	$1.25
LM3909N	LED Flasher/Oscil	$2.90
LM18298T	Dual Bridge Driver	$10.20
LMC555CN	CMOS Timer	$1.40
LMC556CN	Dual CMOS Timer	$3.00
MC14411P	Baud Rate Genr	$27.55
MC33030P	Stepper Driver	$11.80
MM5369AA/N	3.58MHz/60Hz	$3.90
NE558N	Quad Timer	$2.75
TDA1024	Zero X Triac Trigger	$6.00
TEA5501	Encoder/Decoder	$7.65
UC3906N	Lead Acid Charger	$14.90
ULN2208N	See XR-2208CP	$5.15
ULN2209N	See XR-2209CP	$5.85

VARISTORS

VRSTR-130V-7MM	130V 7mm $1.40
VRSTR-275V-12MM	275V 12mm $1.40

COMMS

XR-2206CP	Function Gen	$11.50
XR-2209CP	Precision Osc	$6.40
XR-2240CP	CMOS Timer	$4.25
14409	Bin to Phone Pulse	$11.55
AM7910PC	World Modem	$28.00
AM7911PC	World Modem	$75.55
LM565CN	Phase Locked Loop	$5.55
LM566CN	Voltage Cont Oscltr	$2.20
LM567CN	Tone Decoder	$1.05
LMC567CN	CMOS Tone Dec	$2.40
MC68681	See XR-68C681CP	$27.35
MF4CN-50	4TH Order Filter	$4.45
MF10CCN	Dual Active Filter	$5.20
NE564N	Dgtl Ph Lock Loop	$4.20
NE570N	Compander	$6.25
NE571N	Compander	$4.10
NE572N	Compander	$6.65
TP5088N	DTMF Tone Dialler	$3.60
TP5089N	DTMF Dialler	$2.40
TP5395N	Until Sold	$10.90

TEMPERATURE

LM35DZ	Centigrade Sensor	$2.85
LM335H	Volt M Temp Sens	$4.95
LM335Z	Volt Mode Temp S	$3.95
LM3911N	Temp Contrlr	$2.85
THERMSTR-NTC1K1kΩ	NTC Thermistor	$0.70

Next Month Final Instalment
Voltage references and regulators

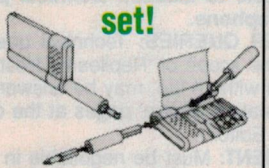
JED PC EPROM Programmer

Australian designed and made and programs most popular EPROM's and FLASH proms. Just connect to the parallel/printer (Centronics) port of any IBM compatible computer using a DB25 connector and you can program 28 and 32 pin devices ranging from 2764 to 27080 and their derivatives. Ideal for use with lap-tops – no plug-in cards or complications. Programmer is completely hand-free. All controls are via the attached computer. Support software gives feedback of progress. Functions available include Blank check, verify EPROM to disk file, Auto ID, Read and Write EPROM to disk. EPROM contents can be viewed and single hex bytes altered. Operation can be either manual or automatic using the built-in ID mode of the EPROM to match the most efficient programming algorithm to the device. Requires only minimal memory as programming is done in "chunks".

Support the local product!

Excellent value **$363.00**

No technician should be without this Screwdriver set!



German quality and ideal for toolbox, glovebox or pocket. Includes universal magnetic holder for use with power drills, 5.5x0.8 and 6.5x1.2 flat, Philips No 1 and2 and Pozidrive No1 and 2 bits.
The great thing is that the case acts as a handle for the bits, so it's self contained in a space of only 70x50x15mm **$20.50**

We carry an extensive range of Witte bits as well as many specialised tools for technicians and servicemen. Call us with your requirements

Electrolube

Clear Mechanical Oil

Extremely efficient lubricant with molybdenum disulphide. Temperature and water resistant. For delicate parts
200ml aerosol **$9.10**

Electrowipes

Lint-free cloths impregnated with electronic grade solvents, individually packed. Solvents evaporate to leave a clean dry surface. 3 types, 10 per pack.
IPA Isopropylalcohol solvent for switches and edge connectors etc
Flammable **$7.50**
Gold contact lubricant improves conductivity and increases lifetime dramatically **$12.50**
ECS Electronic cleaning solvent non-toxic, non-flammable for delicate components, will not harm surrounding plastic parts **$12.50**

Appa 76 Special

- ***Companion to your multimeter***
- ***Tests resistors, capacitors, trimmers, VR's, Diodes, LEDs, SCR's Transistors, Batteries etc***
- ***Save over $40! But there's only 17 of them at $105***



High Quality Silicone Test Leads & Accessories

Sick of those stiff plastic test leads that come with most multimeters? You know the ones that kink and produce pungent smoke when you touch them with your hot soldering iron. Well here's the answer – HCK Silicone Rubber Leads. You wouldn't believe that a 1000V/16A cable could be so flexible and they're soldering iron proof to 300°C. Check our range –

SILIVOLT Reinforced Insulated Silicone Cable

HCK-7604-1/100M	0.25mm/23 300V Cable	$152.35
HCK-7604-2/100M	0.25mm/23 300V Cable	$152.35
HCK-7606-1/M	.75mm/18 1000V per M	$6.55
HCK-7606-2/M	.75mm/18 1000V per M	$6.55
HCK-7606-1/100M	.75mm/18 1000V 100M	$375.65
HCK-7606-2/100M	.75mm/18 1000V 100M	$375.65

2mm SILIVOLT 60V DC Leads (fig 1.)

HCK-9265-1-110	2mm Blk 1.0M Lead	$6.55
HCK-9265-2-110	2mm Red 1.0M Lead	$6.55

2mm Attachments

HCK-8234-1-000	2mm Blk Hook Grip	$5.95
HCK-8234-2-000	2mm Red Hook Grip	$5.95
HCK-9217-1-100	2mm Blk Stackable Plg	$1.35
HCK-9217-2-100	2mm Red Stackable Plg	$1.35
HCK-9225-1-100	2mm Blk Test Prod	$3.85
HCK-9225-2-100	2mm Red Test Prod	$3.85
HCK-9229-1-100	2mm Blk Test Tweezers	$19.20
HCK-9229-2-100	2mm Red Test Tweezers	$19.20

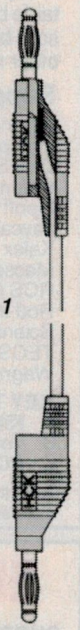


fig 1

4mm SILIVOLT 60V Leads (fig 1)

HCK-7288-1-105	4mm Blk 16A 0.5M Lead	$7.05
HCK-7288-2-105	4mm Red 16A 0.5M Lead	$7.05
HCK-7288-3-105	4mm Blu 16A 0.5M Lead	$7.05
HCK-7288-4-105	4mm Yel 16A 0.5M Lead	$7.05
HCK-7288-5-105	4mm Grn 16A 0.5M Lead	$7.05
HCK-7288-6-105	4mm Vio 16A 0.5M Lead	$7.05
HCK-7288-1-110	4mm Blk 16A 1.0M Lead	$9.05
HCK-7288-2-110	4mm Red 16A 1.0M Lead	$9.05
HCK-7288-3-110	4mm Blu 16A 1.0M Lead	$9.05
HCK-7288-4-110	4mm Yel 16A 1.0M Lead	$9.05
HCK-7288-5-110	4mm Grn 16A 1.0M Lead	$9.05
HCK-7288-6-110	4mm Vio 16A 1.0M Lead	$9.05
HCK-7288-1-115	4mm Blk 16A 1.5M Lead	$11.05
HCK-7288-2-115	4mm Red 16A 1.5M Lead	$11.05
HCK-7288-3-115	4mm Blu 16A 1.5M Lead	$11.05
HCK-7288-4-115	4mm Yel 16A 1.5M Lead	$11.05
HCK-7288-5-115	4mm Grn 16A 1.5M Lead	$11.05
HCK-7288-6-115	4mm Vio 16A 1.5M Lead	$11.05



fig 2 *fig 4*

4mm SILIVOLT 1000V Leads

HCK-9617-1-110	4mm Blk Stght 1.0M Lead (fig 2)	$11.30
HCK-9617-2-110	4mm Red Stght 1.0M Lead (fig 2)	$11.30
HCK-9628-1-110	4mm Blk R/A 1.0M Lead (fig 4)	$12.85
HCK-9628-2-110	4mm Red R/A 1.0M Lead (fig 4)	$12.85
HCK-9635-1-110	4mm Blk Stght 1.0M Lead (fig 3)	$10.70
HCK-9635-2-110	4mm Red Stght 1.0M Lead (fig 3)	$10.70

2mm Socket to 4mm Plug

HCK-9227-1-100	4mm/2mm Blk Adaptor	$2.80
HCK-9227-2-100	4mm/2mm Red Adaptor	$2.80

4mm Attachments

HCK-9120-1-100	4mm Blk Clamp Grip 50mm	$14.65
HCK-9120-2-100	4mm Red Clamp Grip 50mm	$14.65
HCK-9123-1-100	4mm Blk Coupling XHK	$2.55
HCK-9123-2-100	4mm Red Coupling XHK	$2.55
HCK-9755-1-100	4mm Blk Crocodile 34A	$6.50
HCK-9755-2-100	4mm Red Crocodile 34A	$6.50
HCK-9209-1-100	4mm Blk Crocodile 2A	$2.95
HCK-9209-2-100	4mm Red Crocodile 2A	$2.95
HCK-9206-1-100	4mm Blk Hexagonal Probe	$3.65
HCK-9206-2-100	4mm Red Hexagonal Probe	$3.65
HCK-9112-1-100	4mm High Voltage Prod	$5.95
HCK-9112-2-100	4mm Red High Volt Prod	$5.95
HCK-9113-1-100	4mm Blk High Volt Prod	$5.40
HCK-9113-2-100	4mm Red High Volt Prod	$5.40
HCK-9116-1-100	4mm Blk Hook Grip	$13.15
HCK-9116-2-100	4mm Red Hook Grip	$13.15
HCK-9119-1-100	4mm Blk Jaw Grip	$20.40
HCK-9119-2-100	4mm Red Jaw Grip	$20.40
HCK-9214-1-100	4mm Blk Panel Mount Skt	$5.05
HCK-9214-2-100	4mm Red Panel Mount Skt	$5.05
HCK-9205-1-100	4mm Blk Square Probe	$3.35
HCK-9205-2-100	4mm Red Square Probe	$3.35
HCK-9203-1-100	4mm Blk Stackable Plg	$3.45
HCK-9203-2-100	4mm Red Stackable Plg	$3.45
HCK-9230-1-000	4mm Blk Test Tweezers	$16.30
HCK-9230-2-000	4mm Red Test Tweezers	$16.30

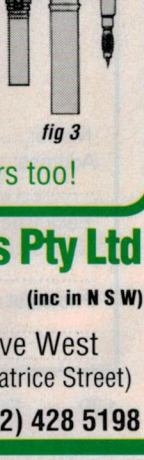


fig 3

Talk to us about Multimeters too!

8.30am to 5.00pm Mon to Thurs., 8.30am to 4.30pm Friday.
Mail Orders add $5.00 min to cover postal charges.
Next day delivery in Sydney add $8.00.
All prices include Sales Tax unless stated otherwise.
Tax exemption certificates accepted if the line value exceeds $10.00.
BANKCARD, MASTERCARD, VISA, CHEQUES or CASH cheerfully accepted.

GEOFF WOOD ELECTRONICS

Geoff Wood Electronics Pty Ltd and Semtech

(inc in N S W)

229 Burns Bay Road, Lane Cove West
N S W 2066 (Corner Beatrice Street)

Telephone : (02) 428 4111 Fax : (02) 428 5198

READER INFO NO. 36

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
Companion Computers	VIC		•					
Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
Geoff Wood Electronics	NSW	•	•	•	•	•	•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Kalex	VIC			•				
Macservice	VIC						•	
RCS Radio	NSW			•				
Rod Irving Electronics	Eastern	•	•	•	•	•	•	•
Scientific Devices	VIC						•	
TECS	VIC	•	•	•	•	•	•	•
Wagner Electronics	NSW		•		•	•	•	

KEY TO CODING:

A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 199, Alexandria 2015; phone (02) 353 9992.

BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**

PHOTOSTAT COPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.

PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.

PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications.

Members of our technical staff are not available to discuss technical problems by telephone.

OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.

PAYMENT: Must be negotiable in Australia and payable to 'Electronics Australia'. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).

ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria, NSW 2015; phone (02) 353 0620.

PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

METHOD OF PAYMENT: (Please circle correct method).

Credit Card: Mastercard, American Express, Visa, Bankcard
Cheque:
Money Order:

Expiry Date:

Name:.....
Address:.....
..... Postcode:.....
Back Issues:.....
.....
.....
Photostat Copies:.....
.....
.....

No.of issues required:.....$7.50=.....
No.of copies required:.....$5.00=.....
No.of copies required:....$15.00=.....

Total Payment Enclosed $ =========

Signature:.....
(Unsigned orders cannot be accepted).

ADVERTISING INDEX

Altronics 88-90
A-One Electronics 12
Askey Australia 25
AV-COMM 51,80
Baltec 73
BIS Australia 33
Campad Electronics 96/97
Computer Hand Holding 123
Consultech 13,IBC
Contan Audio 37
Data Electronics 121
Delsound 32
Delta Components 95
Diamond Valley Eng. 51
Dick Smith Electronics 52-55
EA subscriptions offer 19
ECQ Electronics 119
Fastron Technologies 43
Federal Marketing (Books) 82-83
Geoff Wood Electronics 129
Hewlett-Packard Aust. 18
Hi-Tech Software 73
Intron Electronics 109
Instant PCBs 96/97
Jaycar Electronics 74-77
JED Microprocessors 128
Kalex 17
Melbourne Satellites 33
Memory International 111
ME Technologies 127
National Communications 119
Obiat IFC
Peter Lacey Services 40
Priority Electronics 99
Protel Technology 121
RCS Radio 96/97
Rod Irving Electronics 64-67
RVB Products 109
Southern Sky Magazine 37
Technical Applications 107
Tektronix Australia OBC
TECS Wholesale 63
Tortech 96/97
Transformer Rewinds 96/97
Vintage Wireless Radio Co 95
Yokogawa Australia 43
Yoshi Electronics & Research 127
ZRV Electronics 95

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

Into Computers, Multimedia, Music & Recording? You Should Be Into...

AUSTRALIAN
DIGITAL
MUSIC • RECORDING • MULTIMEDIA



Australian Digital has it covered. Get the most out of tomorrow's technology today.

Have a 12 Month Subscription Delivered to your door for only $17.00

To Subscribe call Toll Free 008 800 933
Sydney residents (02) 353 9992.

On Sale At Your Newsagents Now.

ELF/VLF METER

CONSULTEC ELECTRONICS

is proud to announce the arrival of the TESLATRONIC INC range of Low Frequency Magnetic Field Meters.



TESLATRONICS offers a complete line of accurate and low cost Digital Milligaussmeters with a wide range of features and options suitable for the safety conscious Professional.

Internationally, these meters are used by hundreds of Utility Companies, Consultants, Health and Safety Managers and Field Service Technicians in situations where accuracy and reliability are critical.

The MODEL 50 is a precision, single axis instrument designed to measure ELF magnetic field emissions from a wide variety of sources found in the workplace.

The MODEL 60 is a precision, single axis instrument which can measure both ELF and VLF magnetic field emissions and is highly suitable for establishing compliance to the Internationally recognised Swedish MPR 2 standard.

The MODEL 70 is the top of the line, three axis, precision instrument designed to make accurate spot magnetic field measurements in the ELF /Power frequency band.

STANDARD FEATURES

Precision A to D Converter	CMOS Microprocessor
ContinuouslyAutoranging	Calibrated at 50Hz
ELF Range 0.1 to 1999 mG	VLF Range 0.01 to 1999 mG
60 Hour Power Life	Low Battery Indicator
Selection of Options	Deluxe Carry Case
One Year Warranty	Cal Report Available

For further information and pricing details please contact

CONSULTEC SALES

Ph: (03) 585 1159
or Fax: (03) 584 1169

READER INFO NO. 2



TekMeter™ can show you the answers to questions you haven't even asked yet.

TekMeter™ is the new handheld instrument from Tektronix that combines the functions of a DMM and an oscilloscope. It's practically "auto everything," so you'll get the answers you need faster than ever before.

It's easy. Just connect the probes. TekMeter finds the signal then makes the correct scope or DMM settings to display voltage, current or waveforms in the most meaningful way. What's more, your hands remain free to probe more accurately and safely, especially in small places.

Weighing barely 1 kg, TekMeter includes a host of features like cursors and spike detect that improve your ability to maintain and troubleshoot a wide range of equipment. TekMeter can even capture incoming line voltage spikes and sags, measure voltage and current simultaneously, compute true power, and more - all automatically. For as little as **$1390**.*

TekMeter is the answer you've been looking for. Contact your local Tektronix office today for details, or call Tek direct on **1-800-023342.**



CHECK OUT THE ENTIRE TEKTOOLS™ LINE FOR ALL YOUR MEASUREMENT NEEDS.

*Model THM 550 Ex-Sales tax price © Copyright 1994, Tektronix, Inc. All rights reserved. TekMeter, TekTools, and Tektronix are trademarks of Tektronix, Inc. DPW-284597, Peter D.

Tektronix

READER INFO NO. 3